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FINAL REPORT

19990032

ASSESSMENT AND DEVELOPMENT OF NEW MARKETS FOR SASKATCHEWAN VALUE-ADDED ALFALFA PRODUCTS

Funded by: The Agriculture Development Fund

June 2006

Prepared by: Kapt-Al Services (1998) Ltd.

106-01225/
19990032

Assessment and Development of New Markets For Saskatchewan Value-Added Alfalfa Products

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REGINA, SASK
PROVINCE OF SASKATCHEWAN

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April 2000

EXECUTIVE SUMMARY

Canadian dehydrated and suncured alfalfa pellet sales are experiencing stagnant demand and depressed prices due to record low agriculture commodity values and an Asian market recovering from an economic recession. Competition from compressed bale exports, U.S. cubes and European pellets has reduced the available market for Canadian pellets. To increase sales and reduce reliance on Asian markets requires the development of new markets and uses for alfalfa pellets.

Six new market segments were studied to determine sales opportunities. The segments were: a) soil bioremediation; b) rabbit feed industry; c) horticulture markets; d) aquatic feed industry; e) the health food market, and f) feed products utilizing alfalfa. The first two segments, soil remediation and rabbit feed, represent the greatest opportunities for increased sales of suncured and dehydrated alfalfa pellets, respectively in their current form. The horticulture market represents some opportunity for alfalfa as a substitute for peat, but not as a natural fertilizer. For alfalfa to successfully compete with peat as a soil conditioner, a different manufacturing process will likely be required. Because of the significance of the peat market, it is recommended that the feasibility of manufacturing of alfalfa into a soil conditioner be further investigated; as this could provide an attractive outlet for sub-standard quality, weather damaged alfalfa hay.

The aquatic feed industry and the health industry show no sales opportunities because of a difference between product characteristics and market requirements. Canadian processors have been manufacturing alfalfa based feeds for several years; although there has been little commercial acceptance to date for these products. This is unlikely to turn around in the foreseeable future. However, a pelleted blend of canola meal and alfalfa meal should find ready acceptance in Mexico's dairy industry if market conditions change to improve its price-competitiveness.

The study into supplying alfalfa to the rabbit feed industry has already shown some promising results with sales to date of approximately 500 metric tonnes. An arrangement has been made with an Ontario merchandising company to receive and distribute dehydrated alfalfa into southern Ontario and the northeastern states. This outlet is expected to grow to several thousand tonnes over the next few years.

The research and development of new markets, new uses for alfalfa products, and new products using the industry's capital equipment is tremendously important to maintain a viable alfalfa dehydration industry in Saskatchewan.

Acknowledgement of Support
This study is being funded in part by Saskatchewan Agriculture and Food under the Agriculture Development Fund (ADF) program, whose financial support is gratefully acknowledged.

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BACKGROUND FOR THE STUDY

Agriculture commodity prices have been adversely affected by the recession in Asia and competition from heavily subsidized countries such as the EU and the U.S. The decline in agricultural commodity prices has weighed heavily on the prices of alfalfa pellets and cubes as well as reduced the overall demand for these products.

Sales for suncured alfalfa pellets are particularly difficult. While dehydrated alfalfa pellets have an established market niche in Japanese dairy cattle diets, suncured pellets must compete with other fibre products such as wheat bran pellets, beet pulp pellets, grain screening pellets, etc. These competing fibre ingredients are byproducts of a manufacturing process of a primary commodity. For example, wheat bran pellets are the pelleted bran and screenings that are generated during the wheat milling process. Since byproducts represent a fraction of the overall processing margin from the milling, crushing, or cleaning of grains, the sales price will decrease to a level the market will accept to ensure movement. Historically this price has even dropped to a point where the processor will pay a company to remove the byproduct from the facility.

Unlike other agricultural processors, the dehydration industry is responsible for the on-farm harvesting of the crop. The industry is responsible for harvesting and receiving the crop irrespective of an available market for the commodity, or whether processing margins are below variable costs. As a result of this commitment processing plants are often left with burdensome stocks at the end of the year.

The challenge for the dehydration industry is to continually explore and develop new opportunities for sales of alfalfa products.

OBJECTIVES

The overall objective of this study is to assess the potential of these markets for the purpose of increasing overall sales for Saskatchewan processed alfalfa products and reduce the reliance on overseas markets. Each study segment is unique in terms of the type of market, geographic location, size, and potential. Therefore the objectives and methodology will vary depending upon the subject. Each segment will be presented separately in this report.

CONCLUSIONS AND RECOMMENDATIONS

1. Suncured alfalfa pellets were found to contain the requisite nutrients and organic matter to effectively restore soils contaminated with hydrocarbons. The bioremediation industry, responsible for cleaning up contaminated sites, is a rapidly growing field in North America. The knowledge and utilization of alfalfa pellets by the bioremediation industry is limited but environmental consultants contacted felt it would be a viable remediation agent.

   Research trials and promotion of the results would be required to increase suncured pellet demand by the bioremediation industry. If successful this market could result in annual demand of up to 15,000 metric tonnes in B.C. and over 30,000 metric tonnes throughout Canada.

2. Rabbit feed is comprised of up to 25-50% of dehydrated alfalfa. The majority of rabbit production is in eastern Canada and the north east U.S. The Ontario feed industry supplying to rabbit producers represent a potential market of 36,500 metric tonnes. The New England and New York states estimated demand is 65,700 metric tonnes although a lack or rabbit statistics makes accurate predictions difficult. This market is currently supplied by several small inefficient plants in Ohio and south west Ontario.

   The feed mills generally require small quantities of 2-4 metric tonnes when manufacturing rabbit feeds. This makes transportation difficult when shipped by 80 metric tonne railcars from Saskatchewan. An agreement was made with London Agricultural Commodities (LAC) to receive and distribute alfalfa pellets to the southern Ontario and northern U.S. market. Since July 1999, LAC has received and merchandised 500 metric tonnes of dehydrated alfalfa.

   Research found that feed mills were concerned about dust explosions caused from grinding dry alfalfa pellets. To alleviate this risk and provide customer value, LAC installed exterior grinding equipment to supply ground alfalfa meal to the feed industry.

   The future growth potential for dehydrated alfalfa sales into southern Ontario and the north east U.S. looks very promising. The recommendation is to continue to provide LAC with competitively priced product and support their marketing efforts into the eastern market.

3. Alfalfa pellets and alfalfa teas have shown potential as a natural fertilizer for flowers and shrubbery. However, discussions with major wholesalers have revealed that the size of the natural fertilizer market, relative price, competition for shelf space and consumer preferences would make it difficult for alfalfa pellets to be successfully introduced into the retail market. Current demand potential for alfalfa as a natural fertilizer is estimated to be small at 1,500 metric tonnes.

Suncure alfalfa, however, possesses many characteristics that would suggest it to be a suitable soil conditioner replacement for more expensive peat moss. Modification on processing methods for suncured alfalfa and market promotion could result in a share of the 25,000 metric tonne soil amendment market in B.C. Other markets include the U.S. which account for approximately 600,000 metric tonnes of Canadian peat annually and Japan which imports 75,000 metric tonnes.

As an initial step, it is recommended that further examination of the manufacturing requirements for making an alfalfa soil conditioner be pursued. This could subsequently be followed with the development of a manufacturing procedure and sufficient product to conduct market acceptance tests against peat with soil companies, gardeners and retail establishments.

4. The aquatic feed industry in B.C. manufactures approximately 70,000 metric tonnes for the dozens of commercial fish farms along the west coast. An alfalfa extract containing xanthrophyll is imported from Europe by feed manufacturers to provide pigmentation. Finfish particularly salmon, require a high protein/low fibre diet which makes alfalfa in its current processed form unsuitable. Fractionation of alfalfa could yield a high protein feed additive but would result in a larger amount of lower quality alfalfa to merchandise into the market. Greater research and investment into alfalfa fractionation would be required before Saskatchewan dehy plants could supply this market segment.

5. The herb/food industry in Canada uses approximately 500 tonnes per year of alfalfa leaves. Most of the raw material is imported from the U.S. It is unlikely that Saskatchewan processors would be able to supply this market due to the extremely high quality specifications and health safety regulations at the processing plants. This market represents very little opportunity for the Saskatchewan dehy industry.

6. The dehy alfalfa industry has always had great hopes for the development of a basic animal feed using alfalfa as a base ingredient. Products using a combination of barley, peas, canola meal, and screenings have been developed and manufactured for offshore movement. Unfortunately for a numerous reasons these products have not been commercially viable. This market segment holds very limited opportunity for the Canadian dehy industry. The one possible exception to this is for a pelleted canola meal-alfalfa blend in Mexico which has a demand potential in the neighbourhood of 20,000 MT annually. Current economics, however, does not make it feasible to market a product in competition with unpelleted canola meal produced in Mexico. There may be some benefit in conducting a small trial shipment to obtain initial reaction by dairy farmers in Mexico.

Table 1: Summary of Processed Alfalfa Sales Potential

Market Segment	**Potential Demand** (metric tonnes)			
	Suncured Pellet	Dehy Pellet	Other	Total
Soil Bioremediation				
B.C.	15,000			15,000
Canada/Other	>30,000			>30,000
Health Food				0
Aquatic Feeds				0
Horticulture/Garden				
Natural fertilizer			1,500	1,500
Soil conditioner [1.]			??	??
Rabbit Feeds				
Ontario		36,500		36,500
U.S.		65,700		65,700
Feed [2.]	20,000?			20,000?
Total	>65,000	102,200	1,500	168,700

1. Potential demand not established. However, demand for peat moss as a soil conditioner is estimated at 25,000, 75,000 and 600,000 MT for British Columbia, Japan and USA respectively.

2. Represents the market potential for a canola meal-suncured alfalfa pellet in Mexico which has the potential to be realized only if it becomes price competitive with unpelleted canola meal in Mexico.

INTRODUCTION TO THE STUDY

The purpose of this report is to assess the market potential for alfalfa pellets in new areas or in niche markets. Initial research on possible market outlets revealed potential in five new areas. These areas and a brief explanation of each are listed below.

Alfalfa Pellets Used in Soil Bioremediation – Canada has hundreds of urban and rural sites (gas stations, fuel depots, industrial parks) with varying degrees of soil contamination by oil, gas or chemical spills. Recent legislation dictates that property owners either treat or dispose of the soil to prevent further environmental damage. Recent trials in Quebec and Oregon suggest that suncured alfalfa pellets contain the requisite ingredients necessary to accelerate the breakdown of contaminants in the soil. Detailed information on the use of alfalfa pellets in soil remediation and its market potential has not been documented or quantified.

Alfalfa in Health Food Industry – Interest and consumption of health food products are increasing world-wide. Alfalfa is used as a herbal supplement in the health industry, as well as the food and drug industry. Alfalfa can be used in teas both domestically and abroad. To date, this market has not been supplied by Saskatchewan processors, nor has the size or potential for these products and markets been examined.

High Quality Alfalfa for the Aquatic Feed Industry – Fish farming is the fastest growing sector of agriculture production in North America, especially along the west coast of Canada. A concentrated form of alfalfa is being imported from Europe and is being utilized in Canadian aquatic feeds. If a specialized high quality alfalfa is a practical alternative and is economically feasible to produce, this product could be manufactured and supplied to aquatic feed manufacturers from existing Saskatchewan dehy plants.

Alfalfa Pellets in the Horticulture/Garden Industry – Literature has shown that alfalfa pellets applied either as a top dressing on soils or alfalfa tea as a soil drench has improved the blossom colour and plant vigour in flowers (orchids and irises) and shrubs (roses). It has also been reported to result in a higher yield of tomatoes. Alfalfa is known to contain numerous nutrients (vitamins, minerals, etc.) as well as triacontanol, a plant growth regulator. The potential for alfalfa as a growth promotant in the horticulture/garden industry has not been studied.

Alfalfa Pellets in the Rabbit Industry – Throughout North America, rabbits are raised for pets, meat, and the research industry. The primary ingredient in rabbit feeds are forage products; one type of forage which is dehydrated alfalfa meal. Currently this demand is serviced by U.S. processors. The size of the market and the feasibility of capturing a share of that market by Saskatchewan alfalfa processors has not been determined.

Alfalfa Combined with other Products for the Export Feed Industry – Canadian dehy and cube manufactures have attempted to develop an alfalfa based animal feed for the export feed market. The potential market for these products is very large although marketers have had little success in creating significant demand. This segment is to explore the economic feasibility, plant capacity and end user reaction to these types of products.

ALFALFA PELLETS USED IN SOIL BIOREMEDIATION

Objective

The objective of this report is to:
Determine the possibilities to utilize alfalfa pellets in a bioremediation process.
Attempt to determine the size of the market for alfalfa pellets.
Develop potential marketing strategies for penetrating the bioremediation market.

Methodology

Extensive literature search using the internet and public resources.
Interviews with bioremediation companies.

Introduction

The North American environmental industry is an $8 billion business and is growing by more than 5% annually. Soil bioremediation is a growing sector of this industry due in part to high government investment and legislation in the mid 1990's.

Soil bioremediation involves the utilization of naturally occurring processes to break down contaminants into harmless salts, carbon dioxide, water and biomass components. An in depth background and description of the soil bioremediation process can be found in Appendix I.

Alfalfa Pellets in Soil Bioremediation

Alfalfa pellets contain the requisite nutrients including nitrogen, phosphorus and potassium essential for the microbial process used in soil bioremediation. Its potential utilization will depend on the cost, availability and its effectiveness in reducing soil contaminants.

Biogenie, a Quebec environmental company found that soil amended with peat moss and wood shavings enhanced soil structure and permeability and increased hydrocarbon removal rates by a factor of 20 percent.[1]

In separate unpublished bioremediation projects, Biogenie used a low quality alfalfa pellet in the bioremediation process. Results were mixed, at one site the alfalfa pellets were effective in the remediation of soil but at a second site the pellets did not perform as well. The Biogenie manager at Sainte Foy, P.Q., Ms Marie Claude Drouim, felt that alfalfa pellets were found to be more expensive than other products.

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[1] Biogenic Inc.

According to the environmental industry approximately 90-95% of the polluted sites are contaminated with petrochemical products. Although results are inconclusive, alfalfa pellets are an effective medium to promote soil bioremediation on sites contaminated with petroleum products. The balance of the polluted sites may be contaminated with heavy metals, pesticides, acids, fertilizers and other waste products. Pollutants such as waste products (manure, waste waters) and organic substances such as biocides (pesticides) and certain solvents are relatively easy to remediate so alfalfa should be an effective additive to the soil. Contaminated soils containing heavy metals or radioactive materials are extremely difficult to remediate and alfalfa would not be a suitable additive. A list of the various groupings of contaminants can be found in Appendix V.

Alfalfa pellets are easy to handle, relatively inexpensive and contain the requisite ingredients for successful soil remediation in most cases.

The Bioremediation Industry

There are four major groups within the soil bioremediation industry. These groups include: the Environmental Consultants, the Environmental Contractors, suppliers to the environmental contractors, and the government.

Environmental Consultants

There are approximately 150 environmental consultants across Canada. The largest concentration of consultants are located near the major urban areas of Montreal, Toronto, and Vancouver. Vancouver has approximately 40 environmental consulting firms.

These consultants are approached by real estate or industrial concerns to evaluate site contamination and recommend a remediation process. The consultants then make their recommendations and employ an environmental contractor to conduct the work. The consultant have the final word on the type of process and the ingredients to be used in the remediation. The final approach is usually discussed between the consultant and the contractor.

This group would also include some major corporations who have internal environmental expertise. These corporations include large oil and gas companies such as Shell, Esso, and PetroCanada. Other companies that have internal environmental departments are; pipeline companies, utilities, forestry companies, chemical companies, etc.

Environmental Contractors

Environmental contractors own and operate the facilities and equipment for bioremediation. Environmental contractors operate large contained concrete structures similar in shape to a feed bunker. These structures are often referred to as bio-cells. It is within these structures where the contaminated soils are converted to safe useable soils. These soils can then be used for certain agricultural or horticultural purposes. Often a remediation company will operate a incineration facility to destroy dangerous compounds.

Environmental contractors may also manage in-situ remediation processes. In these instances they will be employed by either an environmental consultant, a private company, or the government to manage clean-up work at a specific location.

There are fewer than 50 of these companies in Canada and perhaps about 10 in B.C. Of these there are three main companies that operate bioremediation ex-situ facilities. These companies are HAZCO Environmental Services Ltd., Sumas Environmental Services Inc., and Quantum Remediation Services Ltd.

HAZCO Environmental Services is a Western Canadian environmental company based in Calgary Alberta. They have several offices and remediation sites across the prairies as well as Vancouver. HAZCO operates a biocell facility in Richmond, which remediates approximately 30,000 – 35,000 tonnes per year in the lower mainland.

Sumas Environmental Services Inc. is based out of Burnaby, B.C. They operate two ex situ facilities, one in Burnaby and the other in Abbotsford. This company uses peat, manure and fertilizer as remediation agents. They remediate approximately 30,000 metric tonnes per year.

Quantum Remediation Services Ltd. are based in Vancouver, B.C. They operate both in situ and ex situ remediation sites. Their ex situ facility is located in Delta B.C. and process approximately 15,000 – 20,000 metric tonnes per year.

The contractors can make recommendations as to the method and agents for remediation but as indicated they do not make the final decision. The contractors are responsible for managing the biological processes and purchasing the necessary ingredients such as fertilizer or various bacteria.

Depending on the severity of the contamination, the cost for soil bioremediation ranges between $25.00 - $50.00 Canadian per metric tonne. Transportation to and from the location is an added cost.

Suppliers

Suppliers represent those companies, which provide products and other services to the contractors. This group would include equipment manufacturers, fertilizer companies, external laboratories, etc. It seems unlikely that the environmental industry represents a large part of the business. This group would be very large and diverse.

Government

The Provincial and Federal governments play a large role in the bioremediation industry. The government makes the regulations as to what constitutes a contaminated site and what standard of contaminant removal is required. The government is also responsible for the majority of funding towards bioremediation research.

A consultant must make an application to the government stating the area to undergo remediation and the method that is to be used. The government approves the process prior to work being started, will monitor the process and inspect the site after completion.

If alfalfa pellets are to be used in the bioremediation process then the respective governmental bodies must approve the technology for the application to proceed.

Market Targeting

The environmental industry involves the cooperation and communication between the various market segments. Marketing alfalfa pellets as a microbial food source for the bioremediation industry will require the acceptance by the bioremediation consultants, environmental contractors and the government. It is unlikely that the introduction of a new product can occur through targeting only one segment. However each group may require a different marketing approach.

Suppliers to this industry are not considered an important target market as the environmental industry is generally a small portion of their overall business.[2]

Environmental Consultants

-final say on the remediation process
-most willing to attempt new processes and techniques
-most creative

Environmental Contractors

-not as creative as the consultants and are more concerned about managing expenses.
-facility managers
-would not be the first group to adopt to a new technology

Government

-funds research on bioremediation processes
-group does not do any purchasing but has an important role in the environmental process through setting standards and enforcing regulations

Market Positioning

Cost of Alfalfa Pellets

Suncured alfalfa pellets in 1999 are worth approximately $90.00 Canadian per metric tonne FOB railcar at a processing facility in Saskatchewan. Rail freight from Saskatchewan to Vancouver is approximately $41.00 Canadian per metric tonne. Transloading costs and delivery by truck will add approximately $10.00 to $20.00 per metric tonne depending upon the transloading site and the destination of the remediation site. The total delivered cost of suncured pellets would equate to $141.00 to $151.00 per metric tonne.

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[2] The exception to this generalization would be companies that specialize in manufacturing and supplying inoculants or nutrient amendments designed specifically for the environment industry.

Effectiveness of the Product

From the available research and discussions with various remediation companies, alfalfa pellets will work as a remediation agents. How effective alfalfa pellets are versus other products will not be known until extensive trial testing occurs.

Value Positioning

An important consideration for remediation companies in conjunction with how effective alfalfa pellets are in the process is the relative value of competing products. The primary remediation agents used in the bioremediation facilities are; manure, yard waste and fertilizer.

Manure

The lower mainland of British Columbia is a large production area for dairy cattle, hogs and poultry supplying the population of Vancouver and the surrounding region. Disposal of animal waste has been a problem due to increasing density of animal production, a reduction of available farmland to spread the waste over due to urban sprawl, and concerns over groundwater and air pollution. There is a need for effective management of animal waste. Supply of manure in the lower mainland is not an issue.

A few of the companies contacted use poultry or cattle manure in their remediation process. The primary reasons for utilizing manure is its availability, the organic content available in manure, the supply of N for microbial food and its low cost. The cost is mainly based on truck freight which can be expensive due to possibly high moisture content. The cost for loading and transportation is estimated to be around $40.00 per tonne.

The disadvantages of using manure are: the odor can be offensive if the remediation site is close to any populated area, and the variable consistency of the manure makes it more difficult to determine precise measurements of applied material during the process.

Yard Waste

Yard waste is obtained through pickup programs from residential areas or collection centres near city garbage collection areas. The cost of the material is limited to the labour and delivery costs which enables remediation companies to acquire material relatively inexpensively. Municipalities support this initiative as it prevents yard waste from being deposited into land fill sites. Yard waste however, is not as effective as other remediation methods.

The problem with using yard waste is the inconsistency of supply. Yard waste is readily available in the spring and fall seasons but falls off especially during the winter months. Hazco, a remediation company in Richmond uses yard waste and also supplies remediated soils for residents in the spring and summer. They must use other products during the winter months.

No values were given for the costs of collecting and utilizing yard waste. The estimate would be $25-$35.00 per metric tonne.

Fertilizer

Fertilizer appears to be the most common remediation agent used. Fertilizer has a consistent quality, it is widely available and is easily stored on site until required. The main disadvantage of fertilizer is its cost, 28-0-0 costs approximately $300 per tonne. Fertilizer does not add any organic material to the soil. As a supply of nitrogen it is more cost effective than alfalfa which has only 3% nitrogen.

Alfalfa is less expensive than fertilizer but significantly more expensive than yard waste or manure.

Conclusions

The North American remediation industry is an $8 billion business growing more than 5% annually. Bioremediation provides a safe inexpensive environmentally friendly method to remove pollutants, mainly hydrocarbons, from soils. This coupled with a high public concern regarding the environment ensures that this type of remediation will continue for years to come.

Alfalfa pellets can be successfully used to remediate soils contaminated with hydrocarbons. However there has not been sufficient research data available to determine how effective alfalfa is versus other remediation materials. Before alfalfa pellets can be actively marketed as a remediation effort it is necessary to conduct trials as to demonstrate how effective pellets are in cleaning soil.

Recommendation: New Product Development

Using alfalfa pellets for soil bioremediation is an innovative use for a product that traditionally fed to animals. Soil remediation contractors who purchase fertilizers or other remediation companies need to be informed and convinced that alfalfa pellets will work as well as or better than their current products and at a reduced cost.

To convince prospective buyers on the merits and advantages of alfalfa will require the development of a market plan. A successful plan should include, testimonials from other users of alfalfa pellets in the remediation process, reliable research results and an opportunity for environmental companies to test alfalfa pellets and derive results for themselves.

The first step is to demonstrate the effectiveness of alfalfa pellets as a remediation effort. This would involve remediation trials breaking down hydrocarbon contaminants using alfalfa as well as other products. This trial would most likely be conducted in an ex-situ site so that other variables such as amount of aeration and water can be controlled. The results of this study will be used as a basis to promote alfalfa pellets to other remediation companies.

HAZCO Environmental Services Ltd. of Richmond, B.C. and Sumas Environmental Services Inc. of Burnaby. B.C. have both expressed interest in conducting this tests for Kapt Al Services. Both companies operate ex-situ remediation facilities which could do the trials. It is recommended that Kapt Al in conjunction with an environmental company conduct studies to measure the effectiveness and efficiency of alfalfa pellets in conjunction with other types of remediation products.

SASKATCHEWAN ALFALFA IN THE HEALTH FOOD INDUSTRY

Objective

To investigate the size and scope of alfalfa product utilization in human consumption.
Determine the possibility of Saskatchewan product to meet this demand.

Methodology

Literary review on internet/library.
Phone interviews/visits with main food processors, distributors and retailers.
Development of a questionnaire on alfalfa usage in the herbal/health industry.

Background On Alfalfa

History

Alfalfa (medicago sativa) has been referred to as the "father of all foods", the "queen of the forages", and the King of Herbs. It is the fourth largest crop in the U.S. behind corn, wheat and soybeans. Alfalfa is widely known as a nutritious feedstuff for livestock.

Alfalfa has been cultivated for thousands of years. It is a member of the pea family and is native to western Asian and the eastern Mediterranean region. Its primary purpose was, as it is now, for a livestock feed. The ancient Arabs fed alfalfa to their horses with the belief it would make them swift and strong. They called it "al-fac-facah" which means "father of all foods". The Greeks and the Romans also cultivated alfalfa as a fodder for their cattle and horses.

Alfalfa has also been produced for human consumption. This has usually taken the form of alfalfa tops and sprouts as a food item but it has also been utilized for centuries as a medicinal herb.

Western medical practices have generally ignored the benefits utilizing herbs based on aboriginal and far eastern techniques. However in recent years, the trend has been towards an increased usage and awareness of traditional herbal remedies for health problems. This shift has been in part due to concerns about adverse side effects of drugs, ineffective medicine and a growing demand for natural or organic products.

The Chinese have used alfalfa since the sixth century to treat kidney stones, and to relieve fluid retention and swelling. In India, Ayurvedic physicians prescribed the leaves and flowering tops for poor digestion. Native North American Indians utilized alfalfa to treat jaundice and to encourage blood clotting. The plant was also used to stimulate lactation in nursing mothers.

In North America it has been a popular folk remedy for arthritis, diabetes, asthma, and hay fever. Alfalfa is a good laxative and a natural diuretic. It is can be used in the treatment of urinary tract infections, and kidney bladder and prostrate disorders. Alkalizes and detoxifies the body, especially the liver. Alfalfa has also been a popular tonic known for augmenting vitality, stimulating appetite, and supporting digestion. Other herbalists believe that alfalfa can help support healthy cholesterol levels and improve the body's defense system.

Certain herbs such as ecanecia, ginsing and St. Johns wort have become very well known by the general public and have stimulated Canadian production of these herbs. It would be very beneficial to the Canadian alfalfa industry if the health benefits of alfalfa were to become better known.

Product Analysis

The constituents in alfalfa are well studied. It is believed that alfalfa draws it nutrient richness from its deep and expansive root system. Alfalfa has 65 vital nutrients including: ash, calcium, chromium, cobalt, fluoride, iron, magnesium, manganese, niacin, phosphorus, potassium, selenium, silicon, sodium, tin and zinc. The vitamins include beta-carotene (Vitamin A), C, D, riboflavin, thiamin, biotin, choline, folikc acid, pantothenic acid and pyridoxine. Alfalfa contains all eight essential amino acids. It contains fatty acids, carbohydrates, protein (17-24%), enzymes, betaine, saponins, alkaloids, flavonoids and sterols.

Uses

The following summarizes the uses of alfalfa from the literature review.

Herbal remedy/medicinal
- relieves pain of joint inflammation
- relieves constipation and gas/bloating
- treats kidney stones, urinary tract infections
- relieve fluid retention
- helps relive arthritis, rheumatoid arthritis,
- aids kidney, prostrate, and bladder disorders.
- treatment for hay fever
- relieves upset stomachs
- reduces symptoms of diabetes
- alleviate allergic reactions to plants and grasses smart basic
- reduces bad breath, gout,
- reduces high fever,

Vitamin supplement/preventative medicine
- detoxification of the body
- supports digestion
- stimulates appetite
- decreases risk of heart disease and cancer

- support cholesterol levels
- improves body defense systems
- promotes pituitary gland function
- inhibit growth of some viruses (such as herpes simplex)
- natural deodorizer
- prevents tooth decay and colds
- control leukemia and cancer cells in animal studies

Food additive
- use of chlorophyll (food colouring)
- beta carotene (Vitamin A)

Summary

Alfalfa is a well known herb and plant utilized throughout the world for thousands of years. Primarily cultivated as a livestock feed, it has a variety of benefits when used as a nutraceutical.

Alfalfa was originally brewed and ingested as a tea and some companies still manufacture some herbal teas containing alfalfa leaves. Many herbal teas that contain alfalfa on the market today also contain other herbs. The main delivery method today of the herbal benefits of alfalfa is through capsule form.

The Canadian Health Products Industry

The Canadian Industry

The Canadian health products industry is large, complex and difficult to define. It includes a wide range of groups including: growers, distributors, vitamin manufacturers, herbalists, homeopathic companies, personal care products, organic foods, and earth friendly products. The philosophy of these groups is based on self-care and being in balance with nature, which is in contrast to the alfalfa industry's agronomic approach and focus on profits.

Agriculture and Agrifood Canada estimate that the total market for natural health food products exceeds $1 billion. (Cdn Health Food Segment) This includes the total sales for retailers, distributors, manufacturers as well as sales through pharmacies, chain drug stores and other businesses that do not merchandise these goods as a primary activity.

Vitamins, herb and supplements represent approximately $415 million in sales for health product retailers, $122 million for distributors and $217 million for manufacturers. The industry however is comprised of very small retailers with only 30% having annual sales in excess of $500,000. It is somewhat different for manufacturers where 50% of total sales are controlled by less than 2% of the group.[3]

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[3] Strategic Policy Choices and The Canadian Health Food Assoc., Canadian Health Food: Industry Sector Analysis

The health product industry in Canada has experienced double digit annual growth in the 1990's. Reasons behind this growth include:

- increasing average age of population
- dissatisfaction of western health care systems
- increasing cost of health care
- increased time for health and fitness
- individuals taking more responsibility for their own health and adopting preventative strategies
- increased interest in returning to more natural life style
- greater awareness and acceptance of benefits of herbal plants and medicines
- greater acceptance by western doctors
- increasing diversity of Canadian population (new immigrants are more apt to utilize herbal medicines)
- improvement in the quality of herbal products

Alfalfa in the Canadian Health Products Industry

The major Canadian herbs are: St. Johns Wort, Gingko Biloba, Saw Palmetto, Echinacea and Goldenseal. These herbs comprise over 50% of the herb market in Canada. There are hundreds of other herbs that comprise the balance of this market including alfalfa. Given the size and relative sophistication of the herb industry, the available information and statistics are very limited. In order to gain a greater knowledge of the size and nature of alfalfa in Canadian industry a number of interviews with herb and pharmaceutical companies were set up.

Survey of Alfalfa in the Canadian Health Products Industry

A survey was conducted to a number of major manufacturers and distributors in the Canadian Health Product Industry. The purpose of this survey was to gain a greater understanding of the utilization of alfalfa in the health products industry which was unavailable through the literature search. Respondents were selected from contact lists supplied by the Canadian Herb Society, from the phone directories and from company names found through visits to various health food stores.

The questions selected were to gauge respondents knowledge of the industry, their knowledge of the application of alfalfa, and finally to determine the alfalfa used in the health industry.

Survey Questions and Responses forAlfalfa in the Herbal, Pharmaceutical and Food Industry

1. How large is the Canadian Herb Industry (annual retail sales)? How large is the B.C. industry?

No one knew the answer to this due to the number of small Canadian processors and the lack of recorded statistics for the industry. It was also found that the U.S. respondents were not sure either of the number of processors or the volume produced. Statistics in this industry appear to be very limited.

2. How many Canadian manufacturers are there (estimate is fine)? How many manufacturers in the U.S.?

Again it seemed that no one would hazard a guess on this number so the question was dropped in later interviews. Given the research the number of Canadian manufacturers is estimated to be between 40-50 across Canada of which there are only three or four major manufacturers.

3. Have you heard of any health products containing alfalfa?

Yes, almost everyone had heard of some health products containing alfalfa

4. Do you know the health benefits of alfalfa?

The knowledge of the health benefits of alfalfa was fairly high. Approximately 65% of the respondents knew something about the health benefits of alfalfa.

5. Have you personally used any alfalfa-based products?

This result was also surprisingly high. Approximately 35% of respondents have personally used alfalfa based products. This was generally in the form of tablets taken as a supplement.

6. What is the consumer's knowledge of alfalfa as a natural health product?

Responses varied for this question. Many felt that consumers were aware of alfalfa only as an animal feed or as a food product, i.e. alfalfa sprouts. Others felt that informed consumers were aware of alfalfa as a herbal product.

7. Are you aware of any studies of alfalfa for its health properties?

Surprisingly only one manufacturer that I spoke to was aware of studies of alfalfa for its health properties.

8. Are there any substitutes for alfalfa?

The products most commonly mentioned as a substitute for alfalfa included: red clover, barley grass and wheat grass.

9. What is the consumption of alfalfa in the Herb Industry?

No individual respondent had any estimates for what the consumption was for alfalfa in the herb industry.

10. Who are the largest manufacturers utilizing alfalfa?

Again no individual could answer this. In Canada it seems that Greens Plus in Montreal and Vita Health in Winnipeg were the major manufacturers of products that include alfalfa.

11. Do you see the potential to increase the usage of alfalfa in the health food market?

Respondents felt that alfalfa consumption in the pharmaceutical industry has been fairly flat the past several years while the consumption of other ingredients has been steadily increasing. Nearly all respondents felt that promotion would increase the consumption of alfalfa.

A few companies had dropped their alfalfa product. Smart Basics for example dropped their alfalfa tablet line as demand for the product had fallen off. A few respondents felt that substitutes such as wheat grass had displaced the demand for alfalfa.

Alfalfa was a very popular, if not faddish, herb used in the 1960's. Since then the herbal industry has grown dramatically with the introduction of new herbs possessing other health benefits.

12. How do you see this happening?

The most common form of advertising for herbal products is in the print media. This would take the form of advertisements in health magazines as well as advertisements posted in stores. The respondents believed that a print media campaign would raise consumer awareness of alfalfa and result in increased demand.

13. Are you aware of alfalfa being used in any food products?

The only response received from this question was "alfalfa sprouts".

14. Are there any regulations, which could impact the marketing of alfalfa in North America?

No one was aware of any regulations that would impact the marketing of alfalfa to the pharmaceutical industry. There was a concern about fallout regarding the news item regarding bacteria content in alfalfa sprouts that would reflect negatively on alfalfa consumption.
In December 1995 and again in 1996 there were outbreaks of salmonella poisoning and sicknesses due to the E. coli bacteria. These outbreaks occurred in Oregon, British Columbia, Georgia, Oklahoma, Pennsylvania, Vermont, Virginia, West Virginia, and Michigan. The U.S. Center for Disease Control linked these outbreaks to contaminated alfalfa sprouts. Alfalfa used in nutraceuticals is dehydrated and processed and pose no health threat. However it is believed that the negative publicity from contaminated sprouts has affected demand for all alfalfa used in the health food industry.

15. Do you purchase alfalfa for your products?

Only the companies that manufactured a product which contained alfalfa could answer this question.

16. From whom do you purchase these products? Do they supply their products from Canadian farms? Or the U.S.?

The majority of the respondents replied that they sourced their alfalfa products from the U.S. The reasons given for this was greater quality control, better quality products and that the U.S. could supply organic alfalfa whereas it was not available from Canadian farms. One reason for this may be that the U.S. has been involved in supplying organic herbal products to the industry for a greater period of time and that it is a very small number of farmers that supply this product. Presumably the transportation and the raw material cost is a very small portion of the overall value of the finished product so there would no economic advantage from supplying it from Canada.
Product was imported from California and Kansas sometimes in a ground form.
The manufacturers of alfalfa products were satisfied with the service of the distributors of the product. There appears to be very little price shopping for the raw materials.

Quality Standards.

Alfalfa must pass very stringent quality standards prior to being accepted as a pharmaceutical ingredient. The primary examinations include an appearance test including taste, colour and odour. The product must be certified as organic. More intensive examinations include: a low bacterial content of under 500 ppm, under 1ppm of heavy metals, salmonella and e coli bacteria must be undetectable.

Not all companies conduct stringent testing, especially if the product came from a grower known to the manufacturer. Often a taste, colour and odour examination was sufficient.

These standards are well above the range that common Canadian agriculture products are tested. This may be another reason why these products are sourced from the U.S.

Strategic Issues Relating to Penetration into the Food Grade Alfalfa Market

Alfalfa produced for dehydration or for the livestock industry involves a different type of management versus alfalfa grown for human consumption. The purpose of this section is to analyze the different issues relating to alfalfa for the health market and how it fits with current production and marketing methods.

Distribution and Marketing Method for Alfalfa in the Health Food Market

The distribution method for alfalfa into the health food market is different from conventional agricultural products. The primary reasons for this is the relatively small size of the industry coupled with the rapid growth in the health food market. The marketing infrastructure is not as well organized or as well defined as it is for conventional crops.

Although the standards for products entering the health food systems are high, there is no official grading system for the marketing of herb products. Buyers generally go by the colour, smell, taste and texture of the herb. Purchases are generally made on the basis of a submitted sample. This is especially true for new growers/marketers of herb products. Buyers also attempt to purchase their product from as few sources as possible to minimize the risk of inconsistent quality and supply.[4]

There are six major groups involved in the distribution of alfalfa into the health food market. The farmer who would grow the herbs and would contract or sell to a pre-processor, an encapsulator, to the vitamin supplement companies, the distributors and finally the retail stores.

With few exceptions the producers who commercially grow herbal products differ from the prairie grain farms. The herb farmers are very small comprising of a few dozen acres and employ intensive organic farming practices. The marketing network is not well defined and herb growers often have a difficult time finding an outlet for their production.

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[4] Gunner, Andrea; Technical Feasibility Study for Medicinal and Aromatic Plants Which Can Be Grown in the Interior of B.C., March 31, 1998

A pre-processor is a distributor who purchases herbs directly from the producer, dries and grinds the product into a powder and then merchandises the product either to an encapsulator or directly to an end product manufacturer.

An encapsulator or tableter purchases the raw dried herbs from the primary producer or from a pre-processor. These processors would take the dried herbs and compress the products into tablets or into capsules (hence the name). The encapsulator would generally sell their product to an end product manufacturer.

An end product manufacturer includes national brand companies or private label manufacturers. These companies which include supplement companies, pharmaceutical firms and health food companies. They manufacture and/or package the tablets for retail distribution.

The end products are merchandised through distributors who supply the health food stores for final sales to the consumer. The health food stores may be independent stores or part of national health food store chains.

Commercial alfalfa production for the animal industry differs significantly from the above distribution pattern. The size and scale of prairie alfalfa production is significantly larger than health food production. Quality of the product is less of a concern than volume and production efficiency. Although commercial alfalfa production does not generally utilize chemicals or artificial fertilizers it can not be regarded as organically produced as required by products entering the health food industry.

Commercial alfalfa marketing differs dramatically from the health industry. Alfalfa growers base their production upon: a) on-farm consumption by livestock, b) local demand from dairies or other livestock, or c) from local alfalfa dehydration companies. Producers who contract alfalfa to dehy companies generally do the least amount of marketing for nearly any other agriculture product.

Trends

The natural health products industry has been experiencing double digit growth in recent years.[5] Alfalfa utilization within this industry has been remained stable but its share has been decreasing as a percentage of the overall industry due to more attractive substitutes in the market place.

Substitute products such as red clover and wheat grass have gained in popularity taking market share away from alfalfa production. Unless new product attributes are discovered or the industry decides to improve the promotion of alfalfa it is unlikely that the declining market share of alfalfa products will reverse.

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[5] Strategic Policy Choices and The Canadian Health Food Assoc., Canadian Health Food: Industry Sector Analysis

Market Strategy

When determining whether to enter a market segment, two considerations should be made. The first question is whether the size of the industry will justify the development and marketing costs to enter it. The second question whether the industry is a suitable complement to the existing core businesses.

The Size of the Industry

The market for alfalfa in the food industry is smaller than originally felt during the initiation of this report. Vita Health, one of the largest Canadian packagers of alfalfa tablets, merchandises approximately 4 million tablets annually. Each dose is approximately 650 milligrams so the annual tonnage would be approximately 260 MT.

There are other smaller manufacturers and distributors of alfalfa leaves such as Enrich Corp.(U.S.), Nutrition For Life (U.S.), and Natures Sunshine (U.S.). However, alfalfa represents a very small portion of their overall product line. Some companies such as Smart Basics quit producing alfalfa pellets as demand for the product declined.

The overall size of the herbal market for alfalfa in Canada is estimated at approximately 500 MT.

The Suitability of the Industry

The dehy industry could theoretically supply either alfalfa leaves for use in the food industry or, it could potentially supply a dehydrated product for further processing. Unfortunately under current conditions it is unlikely that this industry could supply either one to the health food industry.

The alfalfa leaves required by the health and food industry must be certified organic. While many of the fields under contract could be considered organic as artificial chemicals or fertilizers are not generally used during the period alfalfa is in production. However, most growers do not bother to get certification due to the costs and administrative effort involved, not to mention lack of economic incentive. Alfalfa is a rotational crop so preceding crops as well as future crop choices would involve the use of commercial fertilizer and chemicals and hence would not be organic.

The alfalfa processor could potentially supply a product that could be further processed into alfalfa tablets. However the processing conditions of the plant would not be suitable to pass a health inspection by the Canadian Food Inspection Agency. The quality standards for a facility that is suitable for the manufacture of animal feeds would be deemed unsanitary for human consumption products. In addition the facility would have to certified as an organic facility which would prevent it from manufacturing products suitable for the pharmaceutical and health industry. Please refer to Appendix VII for a summary of requirements for a facility to meet food health standards.

Conclusion

Alfalfa has been used for generations for its health and medicinal properties. As a herbal supplement, alfalfa was at its peak popularity during the late 1960's in North America. Alfalfa consumption has remained stable while overall consumption of herbs has dramatically increased particularly in the past 10 years.

Alfalfa usage in the health and food industries is limited and is unlikely to increase unless some unknown properties of the herb become known. Advertising and promotion strategies would increase demand however the cost would outweigh an increase in sales.

The dehydration industry is not well suited to servicing the health product niche. The similarity between the two industries does not go much beyond the alfalfa plant. Production and processing standards for health products are much more stringent than those used in the production of animal feeds. The limited size of the market makes it uneconomical for processing facilities to change manufacturing methods.

Recommended Action

The health market for alfalfa is relatively small and highly quality conscious. Current manufacturing processes utilized would not meet minimum health safety standards for health products. Therefore it is advisable to not pursue this avenue for market differentiation of alfalfa products

ALFALFA PELLETS INTO THE AQUATIC FEED INDUSTRY

Objective

Fish farming also known as aquaculture is a rapidly growing industry in North America, particularly along the West Coast. It was learned that European alfalfa products were being imported into Canada and used in the manufacture of aquatic feed. The purpose of this study is to investigate the potential of marketing Canadian alfalfa products to the fish feed manufacturers.

Methodology

This study will utilize available research from the government, public library system, and the internet. Meetings and discussions with west coast feed manufacturers were also conducted.

The Aquatic Fish Feed Industry.

The aquatic fish industry has grown rapidly the past 20 years. Total aquaculture production in 1984 was $7 million but had grown to $256 million in 1991. Nearly all of the aquaculture production is located on either the east or west coasts.

In British Columbia there are four major companies involved in aquaculture feed production. EWOS, Moore Clark, Agro Pacific and Tatlow Feeds. These companies manufacture and sell approximately 70,000 metric tonnes of aquatic feed annually in the west coast of B.C.

EWOS Canada Ltd. is a European based company with a feed plant in Surrey. This company specializes in aquatic feed. EWOS currently manufactures about 25-30,000 metric tonnes of fish feed annually for the local market.

Moore Clarke is a division of aquatic feed giant Nutreco based in Norway. They operate a feed plant in Vancouver and merchandise approximately 30,000 metric tonnes of fish feed annually. Nutreco is involved in the management of fish farms and feed mills throughout the world. Moore Clarke also has a limited business exporting fish feed to other countries such as Japan.

Agro Pacific is a large commercial feed mill based in Chilliwack B.C. approximately 90 kilometers east of Vancouver. Agro Pacific's main business is dairy and poultry feed but have been aggressive in recent years to build up their aquatic feed business. At this time Agro Pacific has about a 10% market share in the aquatic feeds selling between 5-8000 metric tonnes per year.

Tatlow Feeds, is a small Vancouver based feed manufacturing co with aquatic feed sales of 5-10,000 tonnes per year.

Utilization of Alfalfa In Aquatic Feeds

Fin fish have a high protein requirement for their feed. Salmon require a ration that is comprised of 30 – 55% protein. The most common protein used in these feeds is fish meal which ranges up to 65 - 75% protein. Fish have a low tolerance for fibre that makes alfalfa in its current form an unsuitable feed additive.

The feed companies that were importing an alfalfa extract for fish production were using it for the xanthrophyll content. The xanthrophyll was used to provide pigment to colour the flesh of yellow fin fish. This feed was being manufactured by Moore Clark and exported to Japanese fish farms.

The alfalfa extract is known as PX Super. This is a powder concentrate with a content of 53% protein, 10% fibre, and 1200 ppm of xanthrophyll. It is used in poultry feed formulations as well as in yellow tail fin fish feed for pigmentation of the flesh. It is an expensive product costing approximately $1600.00 MT Can. delivered British Columbia. The usage of the product is only 150 metric tonnes annually, due in part to its high cost.

While the demand for this type of specialized alfalfa for pigmentation would not be sufficient for the development of a plant based fragmentation equipment, alfalfa protein could be utilized in the manufacture of fin fish. This would require processing that would increase the protein content while reducing the percentage of fibre. This might be achieved by using a type of fractionation whereby a higher protein could be extracted from the alfalfa plant. This could reduce the aquatic feed manufacturers reliance on fish meal as a protein source. However, this would create a larger amount of lower quality alfalfa products which are difficult to merchandise in the current market environment.

Moore Clarke Experience with Dehydrated Alfalfa

Encouraged by Kapt Al and Wilbur Ellis[6], the Moore Clarke feedmill in Vancouver attempted to use dehydrated alfalfa as a substitute for the European product. In June 1999 Moore Clarke received approximately 60 metric tonnes of high quality dehydrated alfalfa pellets with a protein of approximately 20%. The results at this point are unknown and their usage of the dehy pellets has been very slow. Six months later Moore Clarke still has dehy inventory at their feedmill.

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[6] Wilbur Ellis Company is a U.S. based grain and feed ingredient merchant and have an office in Vancouver. Wilbur Ellis is the largest supplier of the feed ingredients used at Moore Clarke.

Conclusion and Recommendation for Action

The utilization of alfalfa in the aquatic feed industry seems unlikely given the requirements of the fin fish and the characteristics of alfalfa products. While it is possible that fractionation equipment could be acquired and installed the cost of the equipment and the size of the market make this venture a poor proposition.

This aquatic feed market represents a poor market for alfalfa products at this time and in the foreseeable future.

ALFALFA PELLETS IN THE HORTICULTURE/GARDEN INDUSTRY

Objective

Alfalfa pellets have been shown to contain essential nutrients necessary for plant growth. An opportunity exists to package, distribute and merchandise alfalfa pellets as a "natural" fertilizer. The purpose of this report is to determine the potential for alfalfa pellets in the fertilizer market in the lower mainland of B.C.

Methodology

This report will consist of a literary review of available resources on natural fertilizer as well as interviews with horticultural companies in Vancouver region.

Background

Articles from garden magazines have extolled the virtues of alfalfa pellets and teas applied to garden plants such as roses, orchids and irises. Alfalfa has many benefits for the nutritional needs of plants as well as soil organisms. Alfalfa contains *triacontanol* a plant growth regulator.

Essential nutrients of alfalfa include; Vitamin A, Thiamine, Riboflavin, Pantothenic Acid, Niacin, Pyridoxine, Choline, Proline, Bentaine, Folic Acid, Nitrogen, Potassium, Phosophorus and Manganese.

Research has also revealed the usage of alfalfa in natural fertilizers for the horticulture industry. Although the knowledge and usage of alfalfa is limited there does appear to be a market possibility.

Market segmentation

Research found that there are two major horticultural applications for alfalfa. The first is the utilization of alfalfa as a natural fertilizer. The second is the utilization of alfalfa as a soil conditioner/growing media. The most common growing media in use in North America is peat moss.

Natural Fertilizer

The Canadian Fertilizer Act defines fertilizer as "any substance or mixture of substances, containing nitrogen, phosphorus, potassium or other plant food, manufactured, sold or represented for use as a plant nutrient"[7]. Natural fertilizers are produced and manufactured from organic products. They generally have a lower nitrogen content than commercially manufactured fertilizers because of the lower nitrogen content of their origin materials. Natural fertilizers are generally produced from waste or manufactured by-products and include: vegetable and animal compost; bone meal; canola meal; cottonseed meal; manure; sewage sludge; garbage tankage; blood meal; feather meal; fish meal; fish oil; guano; etc. Before these ingredients can be utilized as a fertilizer some processing is required. The amount of processing required varies depending upon the type of products.

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[7] Fertilizers Act, R.S., c F-9 s.1

The advantages of natural fertilizers are:

- Natural fertilizers contain organic matter than can improve the water and nutrient holding capacity of the soil.
- Natural fertilizers take longer to breakdown and release nutrients. This also helps prevent leaching of nutrients into the soil.
- Natural fertilizers are generally less expensive than inorganic fertilizers. However natural fertilizers are lower in nutrient content and require more material to be applied to receive the same benefit. Natural fertilizers may also be variable in terms of nutrients and it may be difficult to ascertain the appropriate application rate.

Suncured alfalfa pellets do meet the criteria for a natural fertilizer. Alfalfa's fertilizer composition is approximately 2.4:0.3:2.4 (2.4% nitrogen, 0.3% phosphorus, and 2.4% potassium). A comparison of with other natural fertilizers follows below.

Table 2: Natural Fertilizer Comparison

Natural Fertilizer Comparison				**Value**	
	N	**P**	**K**	**Wholesale**	**Retail**
Alfalfa Pellets	2.4	0.3	2.4	$140 MT	$0.12 lb.
Bat guano	6.0	9.0	3.0	n.a.	
Bird guano	13.0	11.0	2.0	n.a.	
Blood meal	13.0	1.5	0.0	$845 MT	$0.50 lb.
Bone meal	14.0	0.0	0.0	$845 MT	
Canola meal	5.0	1.0	1.0	$160 MT	$1.70 lb.
Cattle manure	1.0	0.3	0.5	p.u.cost	
Chicken manure	0.9	0.5	0.8	p.u.cost	
Cotton seed meal	6.0	2.5	2.0	n.a.	
Feather meal	10.0	2.0	6.0	$335 MT	
Fish meal	9.0	7.0	0.0	$800 MT	$1.45 lb.
Horse manure	0.6	0.3	0.5	p.u.cost	
Liquid corn byproduct	4.0	0.0	0.0	n.a.	
Oyster shell	0.2	0.3	0.0	$197 MT	
Peat	2.0	0.3	0.3	$170 MT	$0.38 lb.
Seaweed	1.0	0.5	9.0	n.a.	
Sewage sludge	2.0	1.0	1.0	n.a.	$0.40 lb.
Sheep manure	0.9	0.5	0.8	p.u.cost	$0.21 lb.
Steer manure	1.0	1.0	1.0	p.u.cost	
Tankage	7.0	14.0	0.0	n.a.	

* source: Michigan State University, Vancouver market
**products dried &
screened

The Fertilizer Market in the Lower Mainland of B.C.

The total fertilizer market in the lower mainland is approximately 25-28,000 MT. This usage encompasses conventional farming, institutional usage, horticultural, and home/garden market. The horticulture and home/garden fertilizer market in the lower mainland is 10,000 – 12,000 metric tonnes according to Green Valley, one of the largest packagers of fertilizer for the retail market.

Natural fertilizer usage in the home/garden market represents approximately 10-15% of the total. Natural type ingredients such as bone meal or poultry compost are often fortified with manufactured chemicals, blended with other natural or manufactured ingredients, or are used as a filler for retail products.

The average retail consumer looking for fertilizers or other soil amendment products are concerned more about price and product performance than whether or not the product is natural or not. A new fertilizer item must be able to provide benefit at a comparable price to commercial manufactured fertilizers. The consumer must also be made aware of the supposed benefits of a product before buying it.

The retail segment of the home/garden industry must also be convinced of the merits of a new product prior to stocking and retailing it. Unless it is able to demonstrate that there is sufficient consumer demand, or if suppliers are unable to provide adequate marketing support; retailers will be reluctant to provide any shelf space for a new product.

Alfalfa as a Natural Fertilizer

Alfalfa scores fairly low in the percentage of fertilizer components of nitrogen, phosphorus and potassium relative to other natural fertilizers. It ranks better than cattle, horse and poultry manure but much less than animal byproducts. Animal byproducts such as fish meal and meat meal have a high percentage of protein which makes them useful for the feed industry. Consequently the price for these products is based on the feed protein market that has a higher value than fertilizer. Meat meal for example is approximately 50% protein and has a value of approximately $310.00 per metric tonne. Fish meal has a protein of 65-75% and has a value of $600 - $900 per metric tonne delivered to the feed mill.

Cattle, horse and poultry manures rank the lowest in terms of N-K-P content however they are extremely low cost. In most cases the only cost for manure is the loading and transportation cost from the yard to the field.[8] However raw manure is often inconsistent in quality and has other disadvantages such as odour which requires it to be composted or be further processed in some manner.

Alfalfa pellets fit into the mid-range of natural fertilizers. The approximate value delivered into the lower mainland is roughly $130-$140.00 Canadian per metric tonne. This is about 40% of the value of commercial fertilizer however it is significantly lower in nitrogen, phosphorus, and potassium.

On a bulk basis the price of alfalfa delivered to the lower mainland is $140.00 Canadian per metric tonne. The fertilizer value of alfalfa at 2.4-.0.5-2.4 is more expensive than the comparable values of pelleted sewage waste, and canola meal. It is comparable to peat moss however peat is not used for its fertilizer properties. On a bulk basis alfalfa pellets are not competitive with other natural fertilizers.

The retail market does allow for higher pricing of specialty natural fertilizers. Values for packaged manure for example equate to $200-$400 per tonne. These higher premiums must offset processing costs, packaging, transportation and distribution, marketing and retail costs.

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[8] Please refer to page 12 regarding manure supply in the lower mainland of B.C.

Products such as compost manure, soil, and bone meal are well known consumer products. The introduction of a new product such as alfalfa pellets into the retail sector would require significant marketing to generate consumer interest.

Table 3: Costs for Packaged Alfalfa Products

Marketing Alfalfa Products	
Raw material cost FOB SK	$80.00
Rail freight to B.C.	$44.00
Unloading railcar	$9.00
Packaging (including bag)	$50.00
Shrinkage 3%	$3.75
Delivery to retail location	$20.00
Retail markup 30%	$61.80
Retail price per tonne	$268.55
Price/lb.	$0.12

Under today's environment the price of alfalfa pellets in a retail package would equate to roughly $268.55 which is in line with comparable products. However the above costs do not include market promotion expenses to generate consumer interest in alfalfa pellets for a home/garden natural fertilizer.

Market promotion costs to support the sale of alfalfa pellets would require print advertising, testimonials, sales incentives for retailers, and so on. The costs for market promotion would likely be in excess of $20,000 dollars in the first year. This amount would be acceptable if the market demand is there. However, the home/garden market in the lower mainland is 10,000 – 12,000 tonnes per annum of which only 15% or 1500 metric tonnes is a natural fertilizer market. A successful first year entry into the market might yield a market share of 5% or 75 metric tonnes which is not sufficient tonnage to warrant an aggressive marketing approach into this market.

A more cost effective approach would be to work closely with a horticulture supplier such as Green Leaf to make available to them alfalfa pellets for their own distribution and marketing.

Soil Conditioners

Soil conditioners vary from fertilizers in that they improve the characteristics of the soil but do not add nutrients to the soil. This involves adding organic material or organisms to improve the growing properties of the soil. Peat moss is the most common commercially available ingredient used as a soil conditioner in the horticulture industry today. Other soil conditioners include compost and manure.

Sphagnum peat moss is a popular soil conditioner used extensively throughout North America. It several beneficial properties which aid in plant growth:

-retains water and is able to release it slowly
-reduces nutrient leaching
-provides a good environment for water and air exchange for plants
-adds organic material to soil and prevents soil from hardening
-loosens and aerates soil enabling proper root growth
-free of insects, weeds and other noxious substances
-decomposes slowly
-has little odour

Peat moss is superior to compost and manure due to its availability, handling, and versatility. However the cost of peat moss is much higher than either manure or compost material. Odour is also a problem with manure and some compost material may not be suitable for horticultural uses.

Sphagnum peat moss is produced and exported from Canada. According to the Canadian Sphagnum Peat Moss Association, Canada produced 749,000 metric tonnes of peat moss in 1990 of which approximately 10% was used domestically. The U.S. accounts for 80-90 percent of the peat exports with Japan receiving the balance.[9] It is estimated that the lower mainland region of British Columbia consumer approximately 25,000 metric tonnes annually. The population size and the types of horticulture/agriculture contribute to a slightly larger share of the peat moss consumption.

Peat is mainly used as a soil amendment and a growing medium. Most of the peat is harvested and compressed into bales for the nursery, horticultural and home/garden market. A small percentage is used in soil mixtures along with other ingredients for retail sale. Peat is merchandised through the retail home/garden network. The standard peat bale is 0.71 m3, is comprised of 50% moisture and is double compressed, i.e. compressed to a factor of two to one.

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[9] The Sphagnum Peat Moss Association, 1996

Alfalfa as a Substitute for Peat

Alfalfa has characteristics similar to peat but is available at a much lesser cost. Alfalfa would be a good substitute for peat however it is unknown how well the market would accept this product.

In 1990, Purdue University conducted a study evaluating alfalfa as a substitute for sphagnum peat moss[10]. The purpose of the study was to determine the characteristics consumers want in a horticulture material, determine the competitiveness of an alfalfa as a substitute, and determine the market potential. They surveyed advanced gardeners, commercial flower growers and nurseries. The results of their study can be summarized as follows:

a) Water holding capacity, nutrient holding capacity, and aeration are the most important characteristics for a growing medium.
b) Current substitutes such as hardwood bark, mushroom compost or other peats were substandard in areas such as water holding capacity, availability, and cost.
c) Alfalfa pieces test marketed were approximately 1"inch in length which was considered too small
d) Many survey respondents were ambivalent about the colour, odour, and texture of alfalfa vs. peat.
e) The odour was thought to be pleasing relative to peat by the researchers
f) It was felt that the most marketable product would resemble sphagnum peat. This would require alfalfa to be chopped, decomposed and dried.
g) Experimental results showed that processed alfalfa could only replace approximately 75% of the peat.
h) A 30% discount in price from peat would result in 60% of the horticulture growers and 70% of the home growers switching to alfalfa from peat.

Using the assumption that Indiana gardeners and horticulturists are not significantly different than Canadian gardeners it logically follows that alfalfa products can displace peat if it is competitively priced. Since growers appear to prefer a product that resembles peat alfalfa pellets will not likely be able to be used due to its relatively short fibre. A longer fibre length such as those found in regular cubes would be preferable.

According to the study, if alfalfa is to successfully displace peat it must undergo processing to create a product similar in consistency to sphagnum peat moss. This would require the alfalfa to have a length between 1"-2", be partially decomposed, and be competitive in price. The Canadian dehy industry does have the capability to manufacture to the required specifications to meet this potential market demand.

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[10] Yu, Ziyou; Akridge, Jay T.; Dana, Michael N.; Lowenberg-DeBoer, Jess; An Economic Evaluation of Horticultural Alfalfa as a Substitute for Sphagnum Peat Moss Agribusiness Vol.6, No. 5, 443-462 (1990)

Alfalfa vs. Peat Moss Similarities and Differences

The following charts identify the similarities and differences between alfalfa and peat moss.

Table 4: Similarities and Differences Between Alfalfa and Peat Moss

Similarities Between Alfalfa and Peat Moss
Adds organic matter to the soil – especially sandy soil
Loosens soil
Free of weeds and chemicals
100% natural
Good availability of product
Consistent quality

Differences between Alfalfa and Peat Moss
Retains water although not nearly as much as peat
Decomposes quickly
Alfalfa has better nutrient composition
Alfalfa contains triacontanol - a plant growth regulator
Peat moss has a lower pH level – 3.4 – 4.8
Peat moss has better consumer awareness
Alfalfa has a better aroma
Alfalfa decomposes more rapidly than peat moss
Alfalfa in pellet/cube form is easier to transport and store
Peat moss has greater fibre length

Alfalfa Processing.

One consideration from the Purdue study is the length of the fibre found in peat vs. alfalfa. In their study the 1"length was considered to be short. The length of the fibre found in alfalfa pellets or nutracubes would appear to be shorter than what the market place would require. The second consideration is the decomposition of alfalfa vs. peat moss. A good soil conditioner requires that the medium be partially decomposed prior to being applied to the garden. The following outlines the costs and time to develop an alfalfa product similar in consistency to peat moss. There are four steps involved: the sourcing of raw material, chopping, decomposition and packaging. The costs and procedures are outlined below.

Raw Material

The raw material is readily available from alfalfa fields that are unsuitable for the manufacture of dehydrated alfalfa pellets. In fact, very poor quality, weathered material would be suitable for making the product. The mature alfalfa stand remains in the field until it is cut, baled and brought into the yard. The estimated cost of a 900 lb. alfalfa bale is $25.00 per bale delivered to the processing facility.

Chopping

The first step in the processing process is chopping or grinding the stalks of alfalfa into shorter lengths that can be then more easily dried. This can be achieved by processing the bales into a tub grinder. Since the purpose is to produce a partially decomposed alfalfa product it is not necessary to dry down the chop thereby reducing processing costs. This process would utilize existing equipment such as a tub grinder and a loader, so a nominal value of $10.00 per tonne was used to cover the R&M, fuel, and labour costs.

Decomposition

This involves partially decomposing the alfalfa to make it more suitable as a soil conditioner. In the Purdue study they spread the product onto the ground, watered the chopped alfalfa, and turned the alfalfa over to obtain an even decomposition rate over a period of three weeks. Presumably this was done outside. For this process to be effective in Saskatchewan it this process would need to occur during the summer months.

Again this process would be able to utilize existing equipment and labour at a dehydration facility, although a suitable site would be needed to spread alfalfa onto the ground. The requirement for decomposition would be for a water delivery system to wet the product and a payloader to turn the alfalfa. Although there was no mention of screening or mixing it seems reasonable that some sort of screening would have to be done prior to packaging especially if the decomposition is done on the ground as opposed to a concrete pad.

Packaging

If packing is to be done at the processing facility specialized packaging equipment would be required to produce a professional looking, marketable package. It is unclear without doing trials whether or not some compressing of the product prior to packaging would be required. Utilizing used equipment, we factored in a value of $40.00 per tonne for compressing and packaging alfalfa into bales suitable for shipment.

The chopping, decomposition process will resulting in some shrinkage and losses in the weight and volume of alfalfa. The Purdue experiments indicated a total of 42% loss in weight and a volume loss of 31%. Given that the moisture content of the finished product will be up to nearly 50% from the moisture on the raw alfalfa we believe that the 42% loss to be slightly high. However for the purposes of our example we are using a weight loss of 40% in our calculations.

Table 5: Costs of Processing Alfalfa into a Soil Conditioner

Processing Alfalfa into a Soil Conditioner		
	$/MT	$/kg
Raw material cost	60	0.06
Chopping	10	0.01
Decomposition	10	0.01
Shrinkage 40%	32	0.03
Packaging	40	0.04
Total	152	0.15

Theoretically the cost of producing an alfalfa product to compete with peat moss would be $0.15 per kg of product or about $0.08 per lb. Additional costs to consider prior to retail sale would be transportation, sales and promotion costs, and retail markup.

Transportation costs from Saskatchewan to British Columbia would be approximately $65.00 per tonne via commercial trucking. An additional warehousing and delivery cost would be estimated at $20.00 per tonne for a total cost of $85.00 or $0.04 cents per lb.

Retail mark up would be an estimated 30-40% or another 4 - 6 cents per lb.

In the example for alfalfa pellets, marketing and promotion costs were estimated at $20,000. The peat moss/soil conditioner market is larger than the natural fertilizer market at approximately 25,000 MT per annum. A reasonable market penetration in the first year would be 5% or 125 MT if the product is priced at or near the retail value of peat moss.

The total of cost of the material, processing, transportation and retail markup is $0.18 cents per pound. This value subtracted from the peat price of $0.38 lb. leaves $0.20 for promotion expense. $0.20 equates to $440.00 per metric tonne, multiplied by the market share of 125 metric tonnes equates to $55,000 dollars available for market development costs the first year.

Conclusion

Alfalfa pellets can be used in the horticulture industry as either a natural fertilizer or as a soil amendment. As a natural fertilizer, alfalfa is somewhat more expensive than other commonly available products such as manure or lower in nitrogen than bone meal or canola meal. Alfalfa pellets could compete in this market given an effective marketing program. However, the natural fertilizer market is quite small in southern B.C. and very competitive. The small size and competitive nature of the marketplace would not enable a sufficient margin to afford the promotion required to develop alfalfa as a natural fertilizer. Therefore it is not worth pursuing at this juncture.

Alfalfa, however, does look more promising as a soil amendment. Alfalfa shares many product similarities to peat moss the main soil amendment agent in use today. To compete in the horticulture market with peat moss, alfalfa would have to go through a different processing method to produce a similar and more marketable substitute. The value of the alfalfa plus the cost of the new processing method would be significantly less than the cost of peat moss. Although some product testing and measurement of consumer acceptance would have to undertaken, it appears that there is good potential for alfalfa to compete against peat moss in the horticulture soil amendment market. This product has additional appeal in that it would provide an outlet for sub-standard, weathered forage material that is often unsuitable for processing into either dehy or suncure pellets.

Modification on processing methods for suncured alfalfa and market promotion could result in a share of the 25,000 metric tonne soil amendment market in B.C. Other markets include the U.S. which account for approximately 600,000 metric tonnes of Canadian peat annually and Japan which imports 75,000 metric tonnes. The recommendation is to investigate the processing of alfalfa into a soil conditioner in greater depth; then, if feasible, to develop a trial to manufacture an alfalfa product similar to peat and conduct market acceptance tests against peat with soil companies, gardeners and retail establishments

ALFALFA PELLETS IN THE RABBIT INDUSTRY

Objective

The purpose of this study was to:
Determine the market potential for Saskatchewan processed alfalfa products into Ontario and the North Eastern U.S. markets for utilization for rabbit production.
Identify key participants involved in the rabbit feed/product market.
Develop potential marketing strategies for penetrating the rabbit market.

Methodology

The methods used in this study include literary searches on the internet and public library systems. This study also utilized interviews with market participants on the telephone as well as in person.

Alfalfa in Rabbit Feeds

Generally rabbit feeds are comprised of 30 – 50 percent alfalfa meal. The balance may consist of 5 – 20 percent soybean meal or other sources of protein. Grains such as wheat, oats, mill run, or sorghum which provide energy comprise of 20-45 percent of the ration. Other ingredients may comprise of feed additives such as salt or molasses. A background on rabbit production can be found in Appendix X.

The Southern Ontario Feed Industry

The south western region of Ontario varies from western Canada in terms of the types of crops grown and the intensity of agriculture. This region which is located in the most southern region of Canada has sufficient heat units to produce crops of corn, soybeans and vegetables. The area stretching from Windsor, Ontario to Montreal, Quebec is the most heavily populated region of Canada. To satisfy food demands southern Ontario has evolved into a large production region for swine, dairy and poultry products. As a result feed manufacture is a huge industry in southern Ontario.

As previously mentioned rabbit production is at best a tertiary livestock in Ontario as well as in most other regions. The feed companies that do manufacture rabbit feed do it as a very small component of their regular production runs. Demand may be from local producers or to supply the pet food market. The industry reports that rabbit numbers are relatively stable the past several years.

Interviews with feed manufacturers in Ontario suggest that the incorporation of alfalfa into feed pellets range from 25 – 60 percent depending upon the requirements or preferences of the rabbit producer and the value and availability of substitute products. Due to the limited production runs for rabbit feed the demand for rabbit feed is sporadic and relatively small.

Rabbit fryers consume approximately 160 grams pellets per day (.00016 MT). This would represent approximately 19 metric tonnes of pellets fed per day in Ontario or 7000 tonnes per year using the StatsCan estimate of 120,000 commercially produced rabbits. However this number appears to be too low on a number of counts. The feed usage of alfalfa is significantly higher than suggested by the StatsCan numbers. It is suggested that there are a number of rabbit producers who are not registered as such. Given the size and nature of the industry it is unlikely that accurate statistics can be kept on rabbit numbers.

Joe Abate from Abate Processors in Arthur Ontario estimate that among the three major rabbit packers in Ontario the total kill is approximately 10,000 rabbits. If this is averaged throughout a 50 week year the total number of animals slaughtered is 500,000. This would put the average feed demand at approximately 29,200 per annum without counting pet rabbits, rabbits processed at smaller facilities, and rabbits grown for other purposes. None of the feed companies could estimate the annual feed production for rabbits. However extrapolating from research one could estimate that the annual feed manufactured specifically for rabbits in southern Ontario is 2.5 times the annual slaughter which would put rabbit feed tonnage at 73,000 tonnes. At the high end this would place annual demand for alfalfa in the feed market in southern Ontario at 36,500 tonnes at a 50% inclusion rate. It should also be noted that some of the feed manufactures produce and export rabbit feed to the U.S. but that volume is not likely more than a few thousand tonnes.

The North Eastern U.S. Feed Industry

The North Eastern U.S. is comprised of New York state and the New England states comprised of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island. This region is an old well established agricultural region with a population base of approximately 20 million. The feed industry in New York and the New England states is significantly larger than the Ontario market. The primary animal industry in this region is dairy followed by beef and poultry production. There were no available statistics on rabbit production in this region. According to Dr. Paul Branden of ARSCO Inc. (American Rabbit Systems Company) there are several large meat rabbit farms with between 500-1000 does in this region. There are also several farms that raise laboratory rabbits although there names and size are kept confidential out of fears of reprisals by animal rights activists.

Similar to the Ontario market, the N.E. U.S. feed industry does not have a specialized pet or rabbit feed manufacturing facility. Individual feed plants service the rabbit and other specialized markets on an as needed basis.

The major feed companies in this region are Blue Seal, Agway, and Poulin Grain. These companies operate several large feed mills and farm retail centres. The N.E. region imports most of its grains and other feed materials from the U.S. midwest as well as Ontario and Quebec.

There are no statistics on rabbit production in the N.E. U.S. region. Estimates based on total U.S. slaughter of 6-8 million rabbits and market sources would put the N.E. production in the range of 600,000 – 1,200,000 rabbits. Using an estimate of 900,000 rabbits multiplied by 2.5 to include pet and laboratory rabbits equates to 2.250 million rabbits. 2.250 million rabbits consuming 160 g/day of feed would require 131,400 metric tonnes of feed of which the potential inclusion of alfalfa would be 65,700 metric tonnes.

Ohio Blenders, an alfalfa dehydration firm, based in Toledo, Ohio has a transload site at York, Pennsylvania. This location receives railcars and transloads dehydrated alfalfa pellets into trucks for delivery into the feed mills of New England. It is from this information that we were made aware of the potential size of the alfalfa demand.

The Ontario Alfalfa Dehydration Industry

The alfalfa dehydration industry in Ontario is relatively small with a handful of family owned operations. These plants are smaller than their western counterparts and supply only their domestic feed markets.

There are three major dehy plants in south western Ontario: Lang's Dehy at Teviotdale, Krahlings at Ste. Agathe, and Green-Life Proteins at Brantford. The estimated total production at these facilities is approximately 15-25M MT annually. These three facilities are generally within about 45 miles of the major feedmills in south west Ontario.

Another supplier of alfalfa products to the Ontario feed market is Ohio Blenders. Ohio Blenders is the collection point and the marketing agent for several small dehydration facilities in northern Ohio. They are also buyers of product from western Canada to augment and improve the quality of their dehy alfalfa production. Although Ohio Blenders ships to Ontario their primary market is the north east region of the U.S. Their primary markets are the feed mills that manufacture rabbit feed for producers and pet owners in this region.

These plants do not have the economy of scale afforded to the dehydration facilities in western Canada which individually produce between 20-50M MT of dehy each year. There are also other factors that increase the cost of production such as natural gas costs, land costs, labour costs and so forth.

Table 6: Estimated Dehy Production Costs Ontario vs. Saskatchewan

Estimated Production Costs Ontario vs. Saskatchewan		
(costs per MT)	**Saskatchewan**	**Ontario**
Cost of Sales		
Grower Payments*	20.00	80.00
Harvesting Costs	10.00	12.00
Trucking	8.00	10.00
Depreciation	3.00	3.00
Fuel	4.50	3.50
Processing Costs		
Depreciation	4.50	2.00
Electricity	4.70	5.00
Fuel	1.00	1.00
Insurance	1.00	1.00
Natural Gas**	25.00	50.00
Other supplies	5.00	5.00
Repairs	3.00	3.00
Taxes	1.25	2.00
Wages	9.50	12.00
Total Costs* **	100.45	187.50

*Land rental costs in Saskatchewan range between $25-$40 per acre while in Ontario the costs are $125-$140 per acre. Although Ontario yields are around 3.5 MT per acre vs. 2 MT in Saskatchewan, Ontario growers are more inclined to fertilize their crops adding a cost of $25-$40 per acre.

** Natural gas costs in Ontario are significantly higher in Ontario for two reasons. Firstly the transportation cost to Ontario is high. Secondly, gas consumers in Ontario purchase their gas from the pipeline co. or from a reseller while Saskatchewan processors are able to purchase directly from the gas company. Gas costs in Ontario are 20.7 cents per cubic metre vs. 10.0 cents in Saskatchewan.

*** Despite a lower economy of scale the Ontario costs were kept fairly close to Saskatchewan. Wage rates in Ontario are higher due to a stronger manufacturing economy. Depreciation costs were kept relatively the same due to the older age of the Ontario facilities. Tax rates for Ontario were slightly higher.

According to our estimates of producing dehydrated alfalfa, it costs approximately $87.00 more per tonne to manufacture in Ontario versus Saskatchewan. We estimate the costs of production in Ohio to be similar to Ontario. This theory is somewhat substantiated by the fact that dehy processors in Ontario and Ohio supplement their production with product imported from Saskatchewan.

Alfalfa Logistics in Southern Ontario

Due to relatively small rabbit feed production runs at feedmills in southern Ontario the alfalfa requirements of the feed plants are relatively small usually under 10 metric tonnes or approximately 1/3 of the usual size of a commercial grain trailer. This demand for small quantities generally precludes receiving an entire railcar quantity from Saskatchewan. If a railcar were unloaded by the feedmill, it could theoretically store the surplus pellets until a later date but the savings would be less than the cost of tying up a storage bin until all the product is used up.

Another problem that affects receiving large volumes of alfalfa into the feed mill is that alfalfa pellets must be ground into fines before they are blended into rabbit feed pellets. Taking receipt of a railcar would involve having the capacity to store the pellets until required and having a bin to store ground alfalfa as well as the pellets. .

Alfalfa pellets are generally very dry, usually only 10% moisture. As a result when alfalfa pellets are ground they generate a lot of dust which is released into the air. This dust is similar in composition to grain dust and represents a significant threat for a dust explosion at the mill. Another disadvantage of grinding alfalfa is that the shrinkage can be quite significant as the alfalfa dust escapes into the mill.

As a result of the storage required for the pellets, the extra handling by grinding pellets, the shrinkage, the dust explosion risk and the storage of alfalfa meal, it is generally uneconomical from a feedmill's perspective to import entire railcars of alfalfa pellets from western Canada. However the economics of shipping alfalfa into southern Ontario are very good relative to the cost of dehy manufacture.

The current rate structure <4500-5149 cu ft car> from Tisdale SK. to Eastern Canada is as follows:

Tisdale to Ft. Frances	$1765.00/U.S. Car	Tisdale to Longlac	$2491.00/Can. Car
Ft. Frances to Toledo	$2230.00	Longlac to SW. Ont.	$2215.00
Foreign Exch. 1.5			
Total $ Can.	$5993.00		$4706.00
Per MT <80MT/Car>	$74.90		$58.83

The cost of rail freight for alfalfa pellets to southern Ontario or northern Ohio is approximately $58-$75 Canadian per metric tonne. This freight amount is well below the additional cost of manufacturing dehydrated alfalfa in southern Ontario vs. Saskatchewan.

Servicing the Ontario Market from Saskatchewan

The challenge for a western Canadian manufacturer and merchandiser of a feed commodity is developing, creating and servicing market demand. Developing a market presence will displace the demand for locally produced Ontario alfalfa pellets which will increase competition and lower the sales price. There are a few challenges involved in the development of this market.

There is some product bias with some feed customers that western alfalfa has a different odour and is somehow substandard to Ontario produced product. Given that the digestive system of rabbits is so sensitive changing the source of supply could have disastrous consequences. However, this bias against Saskatchewan alfalfa is unsubstantiated especially considering that processors in Ohio and Ontario import western Canadian alfalfa to blend up or replace locally manufactured product. However this misconception may result in some delays in having the product readily accepted by the market place.

The existing manufacturers of dehydrated alfalfa in eastern Canada will not be willing to give up their local market and will cause pressure with local consumers as well as the Canadian Dehy Association. Loyalty by the Ontario feed market towards domestic dehy processors may also delay acceptance of western product. However long term these eastern companies will not be able to compete.

To effectively enter the southern area market will require: a marketing presence, and an ongoing supply of product.

A marketing presence requires:
-promotion of the product and its availability
-regular contact and offers of product into the market place
-forwarding samples and information to prospective buyers.

The supply of product involves:
-an available supply of alfalfa pellets in a storage tank or similar facility
-an ability to load and weigh trucks and invoice the feed plant
-a capacity to grind product to supply feed mills with ground alfalfa

If the annual alfalfa demand in southern Ontario is 36,000 metric tonnes then a reasonable objective in the first few years would be 20% of that demand or 7200 metric tonnes. Trading margins for small volume commodities are generally between $6.00 to $10.00 per metric tonne. Annual trading revenues would equate to $43,000 to $72,000 which is too low to support the costs of maintaining an exclusive sales person in that market. In addition a facility would have to be found to receive railcars to transload into trucks.

The volume and revenue does not warrant maintaining an office and an individual to merchandise alfalfa products into the southern Ontario market. An obvious solution would be to find an existing merchandiser of feed products who has access to a transload site.

Kapt-Al approached London Agricultural Commodities (LAC) to handle and merchandise alfalfa commodities into southern Ontario. LAC is a small grain elevator and trading company based in southern Ontario. Their business involves purchasing, handling and selling of Ontario grains, western Canadian grains and non-grain feed ingredients (such as canola meal, grain screenings, wheat bran pellets, etc.).

LAC agreed to participate with the sales and distribution of alfalfa in southern Ontario. In order to facilitate trade LAC designated its facility in Seaforth, Ontario approximately 25 miles north of Ontario, to receive pellets via rail. This elevator is located on the CN railway and in the past has received western grains and products for further distribution into Ontario. LAC has since installed a grinder to facilitate the those feed mill requests for ground product.

One advantage of locating the alfalfa distribution at an elevator is it enables feed customers to pick up alfalfa pellets as well as grains which reduces the overall cost of freight. Often feed companies will send their feed trucks to pick up small loads of only 2-4 MT. This saves the feed mills money by not having to tie up bin space with slow moving inventory. It is also expected that having an available supply of product feed companies may increase the usage of alfalfa in the manufacture of rabbit and other feeds.

LAC merchandises feed ingredients to mills in Ontario, Quebec, and the north eastern U.S. states. LAC has added alfalfa pellets and reground alfalfa pellets to their product offerings and approach their existing customer base in Ontario and the northern U.S. states.

Current Status of the LAC Effort

LAC has been working with Kapt Al for the past several months merchandising alfalfa pellets and reground alfalfa to the Ontario and U.S. feed market. Results have been promising although market penetration has been slower than expected.

The Seaforth facility has been working well as far as receiving and storing alfalfa pellets from rail and transloading into trucks. The grinder has been installed and approximately 40% of the outbound loads are shipped as ground product. Seaforth generally keeps about 50-80 MT of pellets in storage. Product is not ground until it is requested. There were some initial problems producing the correct consistency of ground product. This was resolved through the change of the screens on the grinder.

Dehydrated alfalfa shipments the past six months have been approximately 500 MT. This has been much lower than expected. Reasons for the slow movement are as follows:

> - the largest buyer of alfalfa pellets in Ontario is Agribrands Purina. On the first shipment of reground alfalfa it was found that the consistency of their product was below their expectations/standards. This situation has been corrected however they have not been purchasing. The ingredient buyer, Kevin Broadworth, and one of the mill managers are scheduled to visit the plant on January 13.

- Green Leaf Proteins of Brantford, Ontario has been vocal in criticizing the Seaforth operation and has written a letter to the Canadian Dehy Association to complain about the product moving into Ontario. It is believed that Green Leaf has had to drop its prices to compete with the western pellets and maintain market share.
- The Ontario feed industry is a relatively conservative group. Since alfalfa is a relatively minor feed ingredient a more competitive price is not sufficient enough to sway them for their traditional suppliers. It is felt that an ongoing presence in the market by LAC will be the eventual key to increasing market share.

LAC is committed to developing the alfalfa market in southern Ontario and the northern eastern U.S. Although the volumes have been below expectations they believe that perseverance will result in the development of a solid business merchandising alfalfa products.

There are several reasons to expect the dehy business to grow over the upcoming year.

-Agribrands Purina is now showing interest in purchasing alfalfa from LAC Seaforth. Agribrands Purina are significant manufacturers of rabbit and other specialty feeds in southern Ontario. Agribrands is estimated to use 200 – 400 MT of product each month between their four plants in southern Ontario.

-The long term viability of manufacturing dehy in Ontario and Ohio is poor due to the high costs involved. This will eventually result in the closure of the smaller dehy operations reducing competition in this market.

-It is believed that the quality of product from Saskatchewan is better than the Ontario and Ohio product. This belief is derived from the fact that Ontario and Ohio both import western Canadian product to augment and improve domestic production.

-As LAC continues to offer alfalfa products and become known as reliable suppliers of alfalfa products the business will continue to grow.

Conclusion

Rabbits are a versatile animal valued as a source of meat, for its fur, for its use in scientific experimentation, and as a pet. Although the demand for rabbits for the fur and laboratory use has declined in recent years, the demand for meat and as pets continues to grow.

Ontario and the N.E. U.S. are major production areas for commercial rabbits. The main ingredient in rabbit feed is dehydrated alfalfa. Dehydrated alfalfa pellets are generally supplied by small manufacturing facilities located in southern Ontario and Ohio. These facilities are small and generally inefficient relative to the processing plants in Saskatchewan. It is less expensive to manufacture and ship alfalfa pellets from Saskatchewan than to manufacture pellets in Ontario and the N.E. U.S.

The market is too small to support a full time marketer to promote sales of alfalfa into this region. To best service this market would require a site to transload railcars into trucks, storage facilities and the capacity to grind pellets. The best solution is to utilize an existing marketer of agriculture feed ingredients to promote and sell alfalfa products on behalf of Kapt Al.

London Agriculture Commodities (LAC) is a small Ontario based grain and feed ingredient merchandiser based in London Ontario. LAC has a location at Seaforth, Ontario which transloads railcars into trucks and has modified the facility to grind and store alfalfa pellets. This enables the feed market in southern Ontario to pick up small lots of pellets or meal as required. Seaforth is also a grain elevator and feed mills are able to pick up alfalfa pellets in conjunction with corn or other ingredients to maximize freight costs.

The low cost availability and the convenience of purchasing alfalfa pellets from a location close to the southern Ontario feed industry will enable good opportunities for increased growth and penetration into this region.

Study for the Market Development of an Alfalfa Based Animal Feed Product for Export into Japan, Korea, Taiwan, and Mexico

Objective:

1. Determine the feasibility for the manufacture of an alfalfa based feed product using various grain and non-grain feed ingredients.
2. Determine the marketability of the alfalfa based feed product into Japan, Mexico, Korea and Taiwan.

Methodology:

1. Interviews with plant managers, university researchers, other exporters and representatives from other countries.
2. Literary review/search.

Alfalfa Feed Manufacture:

In an effort to add greater value to alfalfa and to increase overall sales, most Canadian processors have considered combining other ingredients with alfalfa in the manufacture of pellets and cubes. The sale of suncured alfalfa products has always been difficult and several attempts have been made by the industry to develop products utilizing suncured alfalfa and other feed ingredients.

From a processors perspective the development of a compound feed must consider the following factors:

- the availability and cost of the various ingredients.
- any restrictions the dehy plant may have in manufacturing a compound feed.
- the integrity of the product. (how well they mill, how well it holds together, storage)

Availability of Ingredients

There are numerous feed ingredients available to blend in with alfalfa for animal feed production. Like all commodities prices vary depending upon demand and supply of the particular product including the time of year, transportation costs, and growing conditions.

The following chart outlines several potentially available products for the dehy plants. These commodities are broken down into grains, non-grain feed items, and feed additives. Grain types vary not only by species but also by grades, admixtures, damaged kernels, moisture conditions and so forth. Availability of specific types of grades will vary depending upon growing conditions throughout the specific year. It should also be noted that manufactured products are more likely than not to contain more than two ingredients.

The Dehy Facility

An alfalfa dehydration facility was designed for processing wet alfalfa into pellets or cubes. To enable a dehy plant to manufacture products other than 100% alfalfa pellets will result in some modification of the physical plant.

Depending upon the materials used and the volume produced specific changes may have to be introduced. Some of the changes include:

- mixing equipment to ensure ingredients are properly blended before manufacture
- smaller bins to hold product as well as store the finished goods
- sophisticated measuring equipment to ensure the application or addition of ingredients
- conveyance equipment to connect the new bins and the mixing equipment
- a feed extruder

Other non mechanical changes

- access to feed nutritional advise and information
- training or hiring new staff experienced in feed manufacture

The Integrity of the Product

Alfalfa feed products must be manufactured in such a way to enable it to maintain its integrity from the manufacturing facility to the end user. This requires that the pellets be manufactured from ingredients that bind together whether in a pellet or a cube form and that the manufacturing process is able to create a product that does not deteriorate during shipment. The feed product must also be consistent in its mixture of alfalfa and other ingredients. Finally the product must be able to be stored without spoilage.

Value Added Application For Suncured Alfalfa Pellets and Cubes

The following chart outlines the feed products, values, availability, and equipment required to manufacture an alfalfa based feed product for the export market. Products vary greatly in terms of price and availability. At this stage market acceptance of the product is not a consideration. Market values were obtained from grain and byproduct merchants active in Saskatchewan.

Table 7: Value Added Applications for Suncured Alfalfa Pellets and Cubes

Value Added Applications for Suncured Alfalfa Pellets and Cubes			
	FOB SK Value	**Availability**	Equipment Requirements
Suncured Pellets	$80.00	very good	
Grains			
1 CW/2CW Barley	$75.00	very good	mixer/storage/interior scales
Flax	$210.00	limited as most flax is produced in south	mixer/storage/interior scales
Heated grain	$50.00	generally not good	mixer/storage/interior scales
Oats	$64.00	good	mixer/storage/interior scales
3 CW Rye	$70.00	dependant upon year	mixer/storage/interior scales
Non-Grain			
Barley sprouts	$90.00	available at Prairie Malt	mixer/storage/interior scales
Beet pulp pellets	$129.00	not available in Saskatchewan	mixer/storage/interior scales
Canola oil	$604.00	available but very expensive	liquid applicator/storage
Canola meal	$112.50	very good	mixer/storage/interior scales
Chick peas	$60.00	good but low quality supply varies each year	mixer/storage/interior scales
Dried distillers grain	$125.00	generally not available	mixer/storage/interior scales
Flax Meal	$120.00	dependant upon the crusher	mixer/storage/interior scales
Grain Screenings	$45.00	good supply	mixer/storage/interior scales
Mixed Feed Oats	$75.00	not feasible as product is in Thunder Bay	mixer/storage/interior scales
Oat Hulls	$30.00	good supply	mixer/storage/interior scales
Oat straw	$30.00	good supply	mixer/storage/interior scales
Lentil screenings	$45.00	variable supply – depends on local demand	mixer/storage/interior scales
Wheat bran pellets	$70.00	from Saskatoon – depends on export market	mixer/storage/interior scales
Wheat straw	$30.00	good supply	mixer/storage/interior scales
Additives			
enzymes	varies	good availability	storage/precise blending equip
vitamins	varies	good availability	

The values used on the following chart were obtained from the marketplace for November 1999.

Development of an Alfalfa Based Export Feed

There are two major considerations for the development of an alfalfa based feed. The first as discussed above is the procurement and processing of a variety of feed ingredients along with alfalfa. The second consideration is the demand of a processed feed including market acceptance and barriers to trade.

The market development for feed should address the following considerations:
- Restrictions on the export of feed from Canada
- Restrictions of the importation of feed by the target countries
- The size of the market
- Buyer acceptance

Restrictions on the Export of Feed from Canada

There are no major restrictions on the export of feed products from Canada. Export shipments usually only require appropriate documentation. Export documentation includes: a bill of lading, an official invoice, a weight and grade certificate, a certificate of origin and usually a phytosanitary certificate.

Export shipments of feed including wheat and barley must be done in conjunction with the CWB (Canadian Wheat Board). On these feed exports, the portion of wheat or barley must be purchased from the CWB. Since the quantity of feed exported will be presumably a small tonnage the price for the wheat or barley will usually be higher by as much as $30 -$40 per tonne over the values obtainable in the non-board (domestic) market. [11]

Export Markets

The agriculture and food industries across Japan, Korea, Taiwan, and Mexico have been undergoing profound changes in production, distribution and trade the past few years. The Agreement on Agriculture at the Uruguay Round of the WTO introduced sweeping changes in the tariff and trade barrier systems of all countries. The net effect of these changes was a general reduction on tariffs and increased trade between nations.

The economies have Japan, Korea, and Taiwan have suffered difficulties in the past few years as a result of the Asian currency crisis, however these countries are recovering quickly. Mexico had severe economic problems in 1995 when they suffered a liquidity crisis due in part to low oil values. The Mexican economy has improved in the past couple of years however access to credit remains difficult.

The agriculture sectors of all four countries are similar in the following manner:
- the agriculture sector represents a shrinking portion of the GNP as other industries grow

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[11] The exception to this rule is on shipments of processed feed to the U.S. Canadian feed manufacturers may export processed feed containing up to 75% domestic feed wheat or barley as long as the grains are denatured in some manner, e.g. rolled, ground, pelleted, etc. A permit is required from the C.W.B. on any export feed shipments.

- the agriculture sector is stagnant and is currently represented by small farms and an aging workforce
- imports of raw grains and oilseeds are expected to grow while agriculture exports are declining
- the governments of these countries are shifting to higher valued crops such as fruit and vegetables
- all these countries have done a lot of work to improve dairy, beef, and swine herds through genetics and advanced animal management
- consumer demand for dairy products and processed foods are increasing

These countries will continue to import corn and other coarse grains as a raw feed ingredient. As the diet of these countries becomes increasingly westernized (Japan is ahead of the other countries on this) and the average salary improves, the demand for processed food items including dairy products as well as the demand for meat will continue to increase. These countries are focusing more on higher value production including meat and dairy production. This creates potential for increasing imports of feed grains including feed products.

Buyer Acceptance

The populations of Mexico, Japan and Korea are significantly larger than Canada. Taiwan's population at 21 million is about 20% less than the population of Canada. All four countries are net importers of coarse grains such as barley and corn to feed their domestic livestock. The potential market for processed feeds exceeds the capacity of Canadian manufacturers to supply it. Trade barriers in the form of tariffs and duties are being reduced down to zero. Acceptance of imported animal feed by the foreign buyer/end user is the major consideration for the market development of a processed Canadian animal feed.

Experience has shown that foreign buyers[12] are generally unwilling to accept and purchase an imported manufactured feed. There are several reasons for this:

Service/Distribution
- Dehy plants are located a great distance from feed users so there would be little communication between feed manufacturers and feed users
- Producers' livestock have specific nutritional requirements often needing the addition of medicine.
- Warehousing of the manufactured feed would be required which would increase the cost and risk through shrinkage and spoilage.

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[12] A buyer could be either a feed manufacturer, an importer or a dairy farmer. A feed manufacturer would have a vested interest in not promoting the importation of feed as it would interfere with their primary business. An importer such as a trading company would have the responsibility to convince end users to purchase the manufactured feed. For the purpose of this report it is not relevant as to whether the buyer is an importer or an end user as the problems and issues facing each group is the same.

Price

- Large foreign feedmills can capitalize on imports of cheaper feedstuffs from other countries or from the domestic market.
- Feedmills would be very aggressive in preventing the importation of processed feed. Possible tactics would include price cutting and using their political influence to deter farmers from purchasing.

Control/Accountability

- Feedmills have control over specific blends which have a proven track record
- Feedmills are usually held responsible if the animals become ill as a result of feed. It would be more difficult to claim against a foreign supplier.

Buyer Perception

- The farmer and the feed mill develop a partnership to ensure the overall wellbeing and productiveness of the livestock. This relationship would be extremely difficult to develop on imported feed.
- A buyer may not have the confidence in a dehy plant to manufacture a reliable feed. This perception could eventually be overcome but it would likely be a long process.

To overcome the unwillingness of buyers to purchase a manufactured feed item, exporters will need to compete with a lower price and a marketing program. Competing on a lower price will likely prove to be unprofitable for the dehy manufactures due to the relatively higher costs of Canadian feedgrains. Canadian exporters would also run the risk of cannibalizing their primary market which are the foreign feed manufacturers resulting in a zero gain.

Market Experience with Alfalfa Based Feed Products

The following section addresses other manufacturers and exporters experiences in the manufacture and export of alfalfa based feed ingredients. This information was obtained from company employees and others involved in the industry. The success of these products was generally limited due to poor acceptance from the buyers.

TIROL International Trading

TIROL is mainly an alfalfa cube manufacturing company located in southern Alberta. At the time of this writing the company had downsized from three facilities down to two.

TIROL manufactured alfalfa and grain cubes for domestic and export sales in the mid 1990's. The grains used were barley and oats. These cubes were mainly sold in the domestic market especially into regions suffering drought conditions. Unfortunately domestic demand was sporadic from year to year and TIROL was unable to establish a regular program. A few containers of alfalfa/grain cubes were shipped to Korea, however demand for this product was very low.

WestCan Alfalfa Inc.

WestCan Alfalfa is the marketing arm for Falher Alfalfa and Alberta Dehy Company. This company mainly exports alfalfa pellets and minicubes as well as a small quantity of regular cubes. WestCan had been involved in the development of a minicube which are a smaller version of a regular cube but are manufactured with conventional extrusion equipment. This venture was very successful however subsequent introductions of various types of products such as their dehy bale have not been commercially viable.

WestCan, through the Falher plant, currently manufactures an alfalfa/pea/canola minicube. This product combines the desirable characteristics of alfalfa with the higher energy from the oil content in canola and the starch content of peas. The cost for canola and peas is greater than the costs for alfalfa increasing the material cost for this product. Additionally, this product is extruded resulting in a higher processing cost than alfalfa. Therefore the cost of the product would make it feasible for a limited number of top dairy producers.

Although no official results are available, shippers report that movement for this product is limited. There is reportedly some limited movement into Japan however it is quite small.

National Alfalfa Trading Co. Ltd.

National Alfalfa operates two dehy facilities in Saskatchewan and a cubing facility in southern Alberta.

This company manufactures two types of barley/alfalfa pellets for the domestic market. The first is referred to as a S40 containing 40% barley and 60% suncured alfalfa and the second is a S60 containing 60% barley and 40% alfalfa. This product was used by feedlots in Alberta and Saskatchewan, especially those that were short feed grains and forages due to drought conditions. National has not exported any alfalfa/grain pellets to the Pacific Rim.

Kapt Al Services (1988) Ltd.

Kapt Al has experience manufacturing and exporting alfalfa pellets combined with canola meal and alfalfa pellets containing feed barley. These have not been successful ventures and the company does not currently manufacture these items.

Mexico Market Study

A recent investigation of the market in Mexico suggests an opportunity for a pelleted canola meal-alfalfa blend in Mexico's dairy feed market. Alfalfa is commonly grown in Mexico for use as a forage in the dairy industry. However, an expected chronic shortage in irrigation water to grow alfalfa may provide some opportunities for the export of Canadian forage products.

Canola meal is also a common dairy feed ingredient available from Mexican crushers. The product is supplied in the meal form rather than pellets because there is a belief that pelleted canola meal (as opposed to unpelleted meal) may cause acidosis when injested by the animal. They believe that the localized concentration of a pellet in the rumen is more conducive to acidosis; unlike a meal that is more widely dispersed within the rumen.

Representatives from Mexico have expressed a strong interest in a pelleted canola meal-alfalfa product because of their interest in importing processed alfalfa and due to the complementary nature of a canola meal-alfalfa combination.

The following gives a rough estimate of the market potential for a pelleted canola meal-alfalfa product in northern Mexico. It is felt that opportunities in Mexico, if any, would be limited to the north; as freight costs would make it prohibitive to market into southern Mexico.

2 million head of dairy cows in Mexico of which 40% are estimated to be in northern Mexico
= 800,000 cows
800,000 dairy cows of which 65% are milking cows = 520,000 milking cows
520,000 milking cows X 2 kg canola meal/d X 305 d
= theoretical demand of 317,200 MT canola meal/ann
317,200 MT X 25% of dairies using canola meal
= estimated actual demand of 79,300 MT canola meal/ann
79,300 MT @ estimated market penetration of 10%
= 7,930 MT canola meal as canola-alfalfa blend.
40% canola meal: 60% alfalfa = 19,825 MT canola-alfalfa pellets

The delivered cost of the canola meal-alfalfa blend to the farm gate in Mexico is calculated as follows:

Canola meal ($125/MT @ 40%)	CAD$ 50
Suncure alfalfa ($45/MT @ 60%)	28
Processing	40
Marketing and fobbing	10
Freight (Tisdale, Sask – Laredo, Texas)	88
Customs, brokerage, import duty	11
Freight to interior Mexico	55
Unloading	3
	CAD$ 285

Canola meal at Guadalajara, Mexico is currently selling for US$150/MT (Mar/00); which is equivalent to CAD$ 220/MT at current exchange rates. Delivery to the farm adds an estimated CAD$ 30-40 for a total delivered cost of CAD$ 255-265/MT. The delivered cost of canola meal-alfalfa pellets would therefore have to decrease by CAD $15-25/MT in order to be competitively priced with canola meal in Mexico. Avenues that might achieve this would be a more cost efficient purchase of canola meal, a reduction in freight costs and the elimination of the import duty.

Conclusions and Recommended Action

The idea of manufacturing an alfalfa based animal feed for the export market has been popular with Canadian dehy and cubing manufacturers. Unfortunately this concept has not been well received by foreign markets for several reasons. Promotional activities by the various companies and the Canadian Dehy Association to develop this market have for the most part been unsuccessful. Although some companies have exported limited amounts of alfalfa based feed products none of these items have been commercially successful.

It is unlikely that foreign markets will represent an opportunity for Canadian dehy manufacturers to export processed feed. If foreign markets do open for imported feed they may be better serviced by the large U.S. feed manufactures situated on the U.S. west coast or from the U.S. Gulf of Mexico. Therefore the opportunity for the alfalfa-based mixed feed market segment is very small and should not be pursued. The exception to this might be a pelleted blend of canola meal and alfalfa for the Mexican market. Price competitiveness, however, must improve before further consideration is warranted.

APPENDIX I: BACKGROUND TO SOIL BIOREMEDIATION

Background

Bioremediation is the treatment of contaminated air, water or soil through the application of microbes that degrade waste materials to less harmful components. Microbes are naturally occurring organisms present in nearly all soils. They are generally bacteria but can be fungi . Under ideal conditions, organic compounds introduced into soil or groundwater are digested by bacteria to satisfy its energy and organic carbon requirements. The byproducts of this process are: carbon dioxide, water, biomass and inorganic salts. Modern technology attempts to increase this natural process by improving environmental conditions for the microbes.

Bioremediation has been described as a new technology. While the term bioremediation is new, the application of microbial activity for water and soil treatment has been around for decades. Treatment systems for municipal wastewater and petroleum refineries utilizing activated sludge and other growth systems have generated information regarding degradation of contaminants through microbial activity.

It was discovered from studies in the mid 1970's that microorganisms naturally present in the soils actively consumed petroleum hydrocarbons and transformed them into carbon dioxide and other harmless elements. These tests provided the information regarding the remediation process and the requirements necessary for these processes. It was learned that the natural microbial action through the addition of nutrients could accelerate the decontamination process. Bioremediation became a new environmental science.

There have been numerous bioremediation projects and studies throughout North America since the tests in the 1970's. Bioremediation has proven effective in degrading or altering many types of contaminants, such as chlorinated and nonchlorinated hydrocarbons, chemicals, solvents, heavy metals, pesticides, petroleum products, and explosives.

In the early 1990's, the Canadian Federal Government funded a number of studies for the development and demonstration of treatment technologies for contaminated site: remediation, characterization, assessment and compliance monitoring. [13]

The DESRT (Development and Demonstration of Site Remediation Technology) Program is a component of the National Contaminated Sites Remediation Program of the Federal Government. NCSRP, and was established to address the NCSRP objectives to work with industry to stimulate the development and demonstration of new and innovative technologies having the potential to resolve problems which are critical to the environmental remediation of contaminated sites. The program shared a portion of the total estimated costs of approved projects through an initial jointly fielded (federal-provincial-territorial) commitment of $50

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million over the period of 1990-1995. Funding was available for both solicited and unsolicited proposals and was negotiated on a case-by- case basis is determined by the potential environmental benefits, and by the degree of technological risk. These studies yielded a tremendous amount of research on bioremediation technology.

Canadian contaminated land legislation followed on the heels of the development of similar legislation in the U.S. In 1980 the U.S. Federal Government passed the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Prior to CERCLA there were no specific laws to address environmental problems created from hazardous waste sites. Serious well publicized environmental incidents such as the Love Canal in New York put public pressure on the government to enact legislation to clean up these sites. A $1.6 billion U.S. *superfund* was established to indentify hazardous waste sites, define the hazardous material present, determine the health and environmental risks and remediate the sites. In 1986, the act was renamed the Superfund Amendments and Reauthorization Act.

This market assessment study will focus on the potential use of alfalfa pellets in the soil bioremediation program. It is important to recognize that in addition to restoring soils to their natural state the protection of the underlying water supplies is also an important consideration. Prior to the early 1980's very little was known how toxic wastes affected the hydrosphere which made it difficult to manage environmental contamination. The U.S. Geological Survey through the Toxic Substance Hydrology Program studied categories of waste throughout the U.S. One of the main findings was that microorganisms affect the fate and transport of toxic substances. Microbial activities in the unsaturated zone (the zone above the water table) affect the contamination of the ground water. Movement of oil through the soil may be aided by the formation of stable emulsions which may result from microbial activity and from non biological processes[14]. Large amounts of oil could leach through the soil and rest on top of the water table.
According to environmental consultants the most common pollutant of soils and the groundwater comes from hydrocarbon contamination in the form of petroleum products. [15] Marine oil spills generally receive more media attention than land spills. They generally are more newsworthy as they can demonstrate a dramatic picture of the damage to the shoreline and to valuable fishing grounds. In contrast, terrestrial oil spills generally occur in isolated or lightly populated areas. Unlike marine spills, terrestrial spills occupy a generally smaller surface area and do not spread to cover a larger area. However, in Canada, the volume of oil spilled annually on land exceeds that on water.

The oil and gas industry in Alberta and Saskatchewan continues to expand. Along with this growth comes an increase in the possibility of spills and contamination of the surrounding area. Oil exploration and site development often cause contamination through minor spills to the surrounding farmland.

Western Canada has hundreds of localized urban sites (gas stations, storage depots, factories) with varying degrees of soil contamination. These sites require either treatment of the soil or complete disposal to prevent further environmental damage and to remove any health threats.

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[14] Page 14, Reclamation of Agriculture Soils After Oil Spills, University of Alberta

[15] One of the leading causes of petroleum contamination is from leaking underground storage tanks.

The western provinces have all created legislation in the past three years to manage and control the remediation of contaminated sites.

Federal Legislation

The basis of federal legislation as it pertains to contaminated soil sites is the Canadian Environmental Protection Act. The Canadian Environmental Protection Act (CEPA) is "an Act respecting the protection of the environment and of human life and health". The Declaration of the Canadian Environmental Protection Act states that "the protection of the environment is essential to the well-being of Canada", underscoring the importance placed by the Government of Canada on the concept of environmental protection. Please refer to Appendix II for the elements of the Canadian Environmental Protection Act.

Protection of the environment is a responsibility shared by all levels of government as well as by industry, organized labour and individuals. For this reason, the Canadian Environmental Protection Act gives the Minister of the Environment the authority to conclude, with the approval of the Governor in Council, agreements with provincial governments concerning the administration of the Act.

The legislation also allows the Governor in Council, upon recommendation of the Minister of the Environment, to recognize, by order, provincial requirements as equivalent to regulations promulgated under the Canadian Environmental Protection Act. The Act also requires the Minister to enter into agreements with the provinces whose requirements are recognized as equivalent, to ensure enforcement of the equivalent provisions. This means that the province will apply its equivalent requirements, rather than the national regulation made under the federal Act. (Government of Canada Publication).

Provincial Regulations

The provincial governments administers and enforces the Federal Environment Protections Act. The government of British Columbia has one of the most stringent provincial environmental regulations in Canada. Appendix III contains details of the B.C. regulations.

Effects of Crude Oil Spills on Soil

The severity of oil contamination is determined by the type of soil, the variety and viscosity of the oil, temperature, and the moisture content of the soil. Heavier soils are more apt to absorb the oil contamination making it more difficult for remediation efforts. Higher moisture contents enable the oil contamination to leach more rapidly through the soil surface.

Oil contamination reduces the rate of water infiltration into soil. This is due to oil coating the surfaces of the soil particles and repelling water. It is not uncommon to see water remaining on the surface of the ground on top of an oil contaminated site.

The oil contamination prevents water and nutrients to travel to the plant's root system. Beneficial microorganisms will suffer due to a lack of oxygen and nutrients carried by the water. As water is prevented from entering the soil and microorganisms decrease the soil structure degenerates into a dry powder incapable of supporting plant life.

Oil contamination causes further damage by clogging the pores of trees and other vegetation restricting the transpiration rate eventually causing the death of the plant.

The Bioremediation Environment

The use of microbes in bioremediation is fundamental to the cleaning up of contaminated soils. Understanding the specific mechanisms and degradation pathways has not been well understood. However research has determined the optimal environment in which these microbes will thrive.

Microorganisms, like all life forms, require food, water, and a suitable environment in which to live grow and multiply. Specifically microbes require the presence of certain micronutrients including; nitrogen, phosphorus, an electron acceptor, appropriate temperatures, water, a pH balance for effective biodegradation. A variety of minerals required by these microbes include: potassium, iron, sulfur, magnesium, calcium and sodium.[16]

Nitrogen is required for microbial components, nucleic acids and proteins. Any restrictions on nitrogen will affect the metabolic functions of the microbe.

Phosphorus is used by the microorganism in the synthesis of phospholipids and nucleic acids. Phosphorus is necessary for the energy transfer reactions. If phosphorus is limited the microorganism's metabolism drops off and reduces their capacity to utilize hydrocarbons in the soil as an organic carbon source.

Managing soil moisture is a critical component of a effective microbial environment. The ideal moisture content of a soil is between 30 - 40% of the soil's holding capacity.[17] Sandy soils require less moisture by weight than heavier clay soils.

The optimal temperature for microbes is between 25-40 Deg C.

The optimum pH for microbial growth is dependent upon the specific microorganisms and their respiration pathways. Aerobic microorganisms can tolerate a wider pH range, while many anaerobes are pH sensitive and operate efficiently in a narrow range. Denitrification and methanogenic biodegradation rates are optimum between pH 7 and 8.

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[16] Michael Scalzi, Soil & Groundwater Cleanup

[17] Michael Scalzi, Soil & Groundwater Cleanup

The most common electron acceptor used is oxygen.

Management of the microbial environment is critical for optimum remediation. Ensuring proper pH and moisture levels, as well as supplies of nitrogen and phosphorus require frequent testing and measurement. The extent and concentration of the contamination are also considerations for site management.

Bioremediation Methods

There are two primary types of bioremediation methods used to recover soil and groundwater contamination. These methods are used to create an optimal environment for microbial activity and to allow the bioremediation process to operate as quickly and efficiently as possible.

The first is *in-situ* remediation which involves the treatment of the soil at the site of contamination. This general method would be used when it is uneconomical to remove the contaminated soil or water to another location for processing. An example of this might be a large oil spill in the prairies caused by a ruptured pipeline.

The second major area of bioremediation is *ex-situ* remediation. This involves removing the soil and transporting it to another site for processing. This would be used when the contamination is hazardous, if the contamination was localized or if it was more economical to remove the contamination rather than treat it onsite. This may include the remediation of soils from around military storage locations or to remove the contamination from an expensive urban lot such as a gas station to a remediation site.

Process for Bioremediation

For each on-site project, the process begins by conducting a biofeasibility study. Soil samples from the contaminated site are obtained and analyzed to determine: nutrient content, contaminant concentrations, and the number of total bacteria and total contaminant-degraders present. Enrichment culturing techniques are used to isolate a culture which is capable of efficient degradation of the contaminant. The optimum soil conditions are then determined and the effects of inoculum and nutrient amendments are studied.

Upon completion of the study, clients are given a report detailing the experimental results and giving conclusions and recommendations concerning the application of bioremediation to the site. If bioremediation is deemed appropriate, full-scale bioremediation is applied to the contaminated site. Both in-situ and ex-situ technologies are applied. In situ applications include soil venting and air sparging. Land farming and biopiles are used for ex-situ remediation. If necessary, a pilot scale demonstration may precede the full-scale implementation phase.

APPENDIX II: THE CANADIAN ENVIRONMENTAL PROTECTION ACT

The Canadian Environmental Protection Act contains the following elements:

1.Authority to control the introduction into Canadian commerce of substances that are new to Canada;

2.Authority to obtain information on and to require testing of both new substances and substances already existing in Canadian commerce.

3. Provisions to control all aspects of the life cycle of toxic substances from their development, manufacture or importation, transport, distribution, storage and use, their release into the environment as emissions at various phases of their life cycle, and their ultimate disposal as waste;

4. Authority to regulate fuels and components of fuels;

5. Authority to regulate emissions and effluents, as well as waste handling and disposal practices of federal departments, boards, agencies and Crown corporations;

6. Provisions to regulate federal works, undertakings and federal lands and waters, where existing legislation administered by the responsible federal department or agency does not provide for the making of regulations to protect the environment;

7. Provisions to create guidelines and codes for environmentally sound practices as well as objectives setting desirable levels of environmental quality.

8. Provisions to control sources of air pollution in Canada where a violation of an international agreement would otherwise result, or where the air pollution affects another country and reciprocal legislation to control the sources of the pollution exists;

9. Provisions to control nutrients, such as phosphates, in water conditioners or cleaning products, including detergents, which can interfere with the use of waters by humans, animals, fish or plants.

10. Provisions to issue permits to control dumping at sea from ships, barges, aircraft and man-made structures (excluding normal discharges from off-shore facilities involved in exploration for, exploitation and processing of seabed mineral resources).

11. Authority to sign agreements with provincial governments regarding administration of the Act.

APPENDIX III: KEY FEATURES OF THE B.C. LEGISLATION AND REGULATON

(Reprinted from Government of B.C. documents)

Site Registry A Site Registry permits easy access to information about sites in BC. Basic characteristics of a site, as well as legal events and milestones in the remediation process will be recorded. The registry also provides information for land transactions and will serve as a ready source of information for the general public.

Fees The legislation provides for cost recovery fees to offset contaminated sites regulatory and administration costs. The fees under the legislation and regulation build upon those in the Contaminated Sites Fees Regulation, which came into effect on July 1, 1995, under the existing provisions in the Waste Management Act.

Alternate Dispute Resolution Because of potential legal actions or lawsuits, resolving disagreements about responsibility and liability issues is often critical in contaminated site remediation. The legislation creates allocation panels which responsible parties can use to help clarify if exemptions or minor contributor status is applicable, and the respective shares of responsible parties. The panel will make recommendations to a regional Pollution Prevention Manager, the government official vested with authority for many regulatory actions.

Public Consultation and Review Sometimes the public is concerned about any health or environmental effects of a site. Persons may want information on possible contamination or to review and comment on remediation plans. The legislation provides for public consultation and review of remediation plans.

Independent Remediation At many sites, responsibility for remediation costs is not in dispute. Remediation may be routine, methods of treatment are readily available, and with the assistance of capable engineering or environmental consultants a site can be remediated with very little involvement by a regulator. So with requirements stated in regulations and environmentally responsible care by site owners, independent site cleanups are practical and sensible. Independent remediation carried out in accordance with regulations is allowed under the legislation, provided the ministry is notified at the onset and at the completion of remediation. Notations will be entered in the site registry.

Five Part Site Management Process The legislation proposes a five part process for managing contaminated sites. Every site need not proceed through each component. For example, many sites, once investigated, will be found not to be contaminated, and require no further attention. The five components are:

1. Identification and assessment;
2. Investigation and determination/decision;
3. Planning;
4. Remediation; and
5. Evaluation/monitoring.

1. Identifying and Assessing Sites Site profiles are an important mechanism for BC Environment to identify potentially contaminated sites. They will contain readily available information and should not require the assistance of a consultant to complete.
Site profiles will usually be required when a local government receives an application for subdivision, zoning, development, demolition of a structure or soil removal (at specific types of former commercial or industrial operations), or when ordered by a regional BC Environment manager. They will be assessed by a local government official, another ministry or BC Environment. The assessment will determine if a site should be subject to further investigation. If not, the site profile will be sent to the Site Registry.

2. Investigating Sites A preliminary site investigation and a detailed site investigation may be required. They may be prompted by a site profile or other information a regional Pollution Prevention Manager may receive. Preliminary site investigations assess the probability of site contamination through archival records, site visits and knowledge of historical activities conducted on site. Detailed site investigations confirm or refute the potential of site contamination by sampling and chemical analysis of soils, sediments, surface water and groundwater.

The legislation provides for numerical and risk-based standards to determine when cleanup is needed and satisfactorily completed. The regulations give further details about the magnitude and use of standards in cleaning up sites.

Legally Determining if a Site is Contaminated Provision is made for a preliminary determination and final determination by a regional Pollution Prevention Manager, with notification of liable parties at each stage. A determination is not required for every site, but a lack of a determination does not mean a site is not contaminated. For example, independent remediation may occur or a voluntary remediation agreement may be developed without a formal determination.

3. Planning Stage – Determining Liability Currently, responsibility for remediation is stated very broadly in the Act. Regional Pollution Prevention Managers have broad authority to order investigations and site cleanup. In its current form, it is not easy to predict responsibility and there are no exemptions from liability. The legislation brings clarity and predictability to liability issues, facilitating planning for future costs.

The legislation first casts a relatively "broad net" of liability. Persons potentially responsible, for example, may include current or former owners of a contaminated site or a site from which contamination migrated. Persons potentially responsible may also include producers or transporters of substances.

To achieve fairness and to implement the "polluter pays" principle, the legislation then provides many exemptions from liability including:

a government body involuntarily acquiring ownership of contaminated land;
a person whose site is contaminated only by migration from another site; and
secured creditors who act only to protect their financial interest and do not, in any way, cause or increase contamination.

The legislation allows a manager to confer minor contributor status to a person who contributed only a minor part of the contamination at a site. This shields against private lawsuits and remediation orders from BC Environment, thus limiting liability. Additional liability provisions relate to ministry remediation orders.

General liability principles follow those already in place in the Waste Management Act, concerning pollution abatement order powers. A person who is responsible for remediation is absolutely, retroactively, and jointly and severally liable.

Assessing Need and Priority for Remediation Criteria are provided to guide managers in determining the need and priority for remediation orders. If a contaminated site needs to be remediated, the timing will depend on the severity of the actual or potential impacts. Some sites may not need to be cleaned up for years, or ever.

Activating Remediation A voluntary remediation agreement or a remediation order can be used to document responsibility and to set out conditions required to address contamination. A voluntary remediation agreement may be used where a person agrees to responsibility and remediation procedures. It may deal with: responsibility and contributions to remediation; information disclosure; financial guarantees; remediation schedules; and requirements to achieve satisfactory remediation.

A regional Pollution Prevention Manager may issue a remediation order if a person will not agree to responsibility or remediation requirements. It deals with similar matters to a voluntary remediation agreement.

Evaluating Remediation Options Identification and investigation of a contaminated site may be followed by planning for remediation. There are often several different options to clean up a site and one, or a combination may be selected. The legislation provides explicit criteria for evaluating options including: effects on human health and the environment; technical feasibility and risks; and remediation costs and economics.

Approvals in Principle Financing and local government development approvals of sites with contamination can be significantly impeded without a clear process for dealing with contamination. A local government or a lender may require assurance that a site has been adequately investigated and that acceptable plans have been developed for remediation.

The legislation provides an optional approval in principle. Investigation results, evaluation of remediation options, public consultation input and remediation plans would be reviewed, and if satisfactory could culminate in a manager issuing an approval in principle.

Contaminated Soil Relocation Excavation at a contaminated site may be required to develop underground facilities. Relocating surplus soil, either to a landfill, or for use as fill at another site may in some cases also be an acceptable remediation option. In the past, the management of excavated soils has often been surrounded by uncertainty. Adequate controls are needed, including appropriate standards.

Contaminated soil relocation agreements are included in the legislation. These agreements, along with requirements for information on soil quality and conditions of the environment at a deposit site, provide a uniform system of managing soil relocation.

4. Implementing Remediation Remediation is defined in the legislation to cover all stages of site management from preliminary investigations, through implementing remediation procedures, to final monitoring. However, remediation is commonly viewed more narrowly as the removal or treatment required to clean up or secure a site.

The legislation provides a framework for two broad types of remediation. Contamination may be: 1) removed so that it no longer remains at a site or 2) treated onsite. The regulation provides standards for the quality of soils and water that may remain at a site when cleanup is considered complete. Or, health risk assessment and environmental impact assessment may be used to document that under a specific use, contamination may remain onsite. Additional protective measures may have to be installed.

5. Documenting Remediation Completion Remediation completion documents can be provided for the two types of remediation above. Certificates of compliance can be issued if numerical standards in the regulations have been satisfied. Conditional certificates of compliance can be issued if risk-based standards and related assessment procedures have been applied. In both cases, financial guarantees or other security may be required.

Confirmatory sampling and analysis to the satisfaction of BC Environment are normally required if a certificate of compliance is to be issued. When contamination is managed onsite, certain conditions must be adhered to. These are necessary, for example, for protection of the environment or human health, or notification of future site owners, operators or adjoining owners or operators. Current practice requires that a restrictive covenant be registered on the property title. BC Environment believes that a conditional certificate of compliance and the Site Registry will substitute in many cases for a restrictive covenant under the Land Title Act.

Declaration of Need for Remediation Some sites may require prompt action if they pose a serious threat to the environment or human health. The legislation authorizes the Minister to declare the need for remediation at a high risk orphan site or another site. Labour, services, materials, equipment, and entry onto land may be ordered. The legislation also provides access to provincial funds for orphan site cleanup.

Future Action Similar to other jurisdictions, provision is made for 'reopening' the issue of remediation at a site. Conditions which might compel such action include:

additional information about a person's responsibility;

a change in standards precipitated, for example, by new toxicity information; or

failure to exercise due care in management of contamination.

APPENDIX IV: SOIL REMEDIATION METHODS

Infiltration galleries are dynamic insitu treatment systems designed to stimulate microbial activity. By circulating nutrient and oxygen amended water through soil. The ex-situ version of this would be the construction of a bio-cell. A bio cell is a man-made structure located at an external site which would remediate contaminated soil delivered for clean up.

Bioventing is the process of supplying air or oxygen to stimulate the aerobic biodegradation of contaminants. Air can be pumped in through wells in the unsaturated zone, or pumped out of contaminated areas.

Air sparging similar to bioventing but refers to air pumped below the water table to treat contamination. Air sparging and bioventing are often used in combination.

Composting is a natural biologic process of decomposition where organic solid wastes are aerobically degraded into compost, a stable humus like substance which has useful properties as a soil conditioner.

Land farming is an ex-situ process involves transporting the contaminated product to a site to be incorporated with natural soils to dilute the contamination and result in a nature restorative process.

Pneumatic fracturing is a type of remediation technology to increase the efficiency of other in situ technologies in difficult soil conditions. This involves injecting pressurized air into the soil to develop cracks which increase the availability of oxygen and nutrients to the micro-organisms.

Soil flushing is the extraction of soil contaminants using water or similar solutions. This is often accomplished by passing the extraction fluid through soil using an injection or infiltration process.

Soil vapor extraction involves using a vacuum to control the air flow in an in situ system and remove possibly volatile compounds.

Natural attenuation also known as intrinsic bioremediation is allowing the natural process of remediation to occur without any intervention. This is not a technology per se but rather a conscious decision to allow the forces of nature to remediate a contaminated area. The rate of remediation will be slower than other methods but it is the least costly method of removing contaminants.

Phytoremediation involves the in situ use of plants to stabilize or restore contaminated sites. Phytoremediation mechanisms include enhanced rhizosphere biodegradation, phytoaccumulation, phytodegradation and phytostabilization.

APPENDIX V: MAJOR CATEGORIES OF POLLUTANTS

Saskatchewan Environment and Resource Management Spill Reporting Requirements

Pollutants	Form, Character or Concentration	Onsite	Not Onsite
A. Substances listed under the Environmental Contaminants Act			
1. Polychlorinated biphenyls PCB	anything containing PCB	1 kg	50 g
2. Polychlorinated terphenyls PCT	anything containing PCT	1 kg	50 g
3. Polybrominated biphenyls PBB	anything containing PBB	1 kg	50 g
4. Mirex (also known as dechlorane)	anything containing Mirex	1 kg	50 g
5. Other substances listed in regulations under the Environmental Contaminants Act		1 kg	50 g
B. Petroleum & petroleum products			
6. Gasoline	liquid	200 L	100 L
	liquid from above ground container	500 L	
	liquid from below ground container	any subsurface loss	
7. Diesel fuel	liquid	200 L	100 L
	liquid from above ground container	500 L	
	liquid from below ground container	any subsurface loss	
8. Bunker oils, aviation fuel jet fuel, kerosene, stove oil	liquid	200 L	100 L
	liquid from above ground container	500 L	
	liquid from below ground container	any subsurface loss	
9. Lubricating oils	liquid	100 L	50 L
10. Asphalt	liquid	500 L	100 L
11. Other petroleum products	liquid	100 L	50 L

C. Organic biocides (pesticides)		
12. Abate	15 kg	5 kg
13. Aldrin	1 kg	100 kg
14. Asulam	50 kg	20 kg
15. Atrazine	5 kg	1 kg
16. Azinphosmethyl	1 kg	100 kg
17. Barban	5 kg	1 kg
18. Benazolin	50 kg	20 kg
19. Benzoylprop ethyl	30 kg	10 kg
20. Bromoxynil	15 kg	5 kg
21. Carbaryl	15 kg	5 kg
22. Carbofuran	5 kg	1 kg
23. Chlordane	1 kg	100 kg
24. Chlorfenrinphos	5 kg	1 kg
25. Chlorpyrifos	5 kg	1 kg
26. 2,4-D; 2,4-DB; 2,4-DP	15 kg	5 kg
27. Dalapon	50 kg	20 kg
28. DDT, DDD or DDE	1 kg	100 g
29. Diazinon	15 kg	5 kg
30. Dicamba	15 kg	1 kg
31. Dichloroprop	30 kg	10 kg
32. Diclofopmethyl	30 kg	10 kg
33. Dieldrin	1 kg	100 g
34. Dimethoate	30 kg	10 kg
35. Dinitramine	50 kg	20 kg
36. Dinoseb	5 kg	1 kg
37. Endosulfan	1 kg	100 g
38. Endrin	1 kg	100 g
39. EPTC	30 kg	10 kg
40. Ethion	5 kg	1 kg
41. Fenitrothion	5 kg	1 kg
42. Flampropmethyl	30 kg	10 kg
43. Fonofos	5 kg	1 kg
44. Glyphosate	50 kg	20 kg
45. Heptachlor	1 kg	100 g
46. Heptachlor expoxide	1 kg	100 g
47. Lindane	1 kg	100 g
48. Linuron	30 kg	10 kg
49. Malathion	15 kg	5 kg
50. MCPA;MCPB	15 kg	5 kg
51. Mecoprop	15 kg	5 kg
52. Methamidophos	1 kg	100 g

53. Methiadathion		5 kg	1 kg
54. Methomyl		15 kg	5 kg
55. Methoxychlor		5 kg	1 kg
56. Metribuzin		30 kg	10 kg
57. Niclfen		50 kg	20 kg
58. Paraquat		15 kg	5 kg
59. Parathion		1 kg	100 g
60. Picloram		5 kg	1 kg
61. Propanil		15 kg	5 kg
62. Simazine		5 kg	1 kg
63. 2,4,5-T;2,4,5-TP		any amt.	any amt.
64. TCA		30 kg	10 kg
65. Toxaphene		1 kg	100 g
66. Triallate		30 kg	10 kg
67. Trifluralin		15 kg	5 kg
68. Other biocides		1 kg	100 g
D. Acids and Bases			
69. Acetic acid		100 kg	20 kg
70. Hydrochloric acid		50 kg	10 kg
71. Hydrofluoric acid		5 kg	1 kg
72. Nitric acid		50 kg	10 kg
73. Oleum		50 kg	10 kg
74. Phosphoric acid		50 kg	10 kg
75. Sulfuric acid		50 kg	10 kg
76. Sodium hydroxide		100 kg	20 kg
77. Potassium hydroxide		100 kg	20 kg
78. Calcium hydroxide		500 kg	100 kg
79. Other acids and bases		50 kg	10 kg
E. Miscellaneous Organic Substances			
80. Halogenated solvents	liquid	25 L	5 L
81. Non-halogenated solvents	liquid	25 L	5 L
82. Acrylonitrile (vinyl cyanide)	liquid	25 L	5 L
83. Vinyl chloride	liquid	10 L	2 L
84. Chlorobenzenes	liquid	any amt.	any amt.
85. Chlorophenois	liquid	10 L	2 L
86. Methanol	liquid	500 L	100 L
87. Edible oils	liquid	500 kg	250 kg
88. Urea		500 kg	100 kg
89. Other organic substants		25 kg	5 kg
F. Miscellaneous Inorganic Substances			

90. Ammonia anhydrous (container failure)		any amt.	any amt.
91. Ammonia liquid		100 kg	50 kg
92. Calcium chloride		1000 kg	500 kg
93. Chlorine	liquid/solid	100 kg	20 kg
94. Chlorine gas (container failure)		any amt.	any amt.
95. Cyanide compounds		5 kg	1 kg
96. Fertilizers - nitrogen		100 kg	50 kg
Fertilizers - phosphate		50 kg	10 kg
97. Hydrogen flouride gas (container failure)		any amt.	any amt.
98. Potassium chloride (potash)		1000 kg	500 kg
99. Potassium permanganate		100 kg	20 kg
100. Sodium chloride (salt)		1000 kg	500 kg
101. Sodium sulphate		1000 kg	500 kg
102. Sulfur		500 kg	250 kg
103. Other inorganic substances		100 kg	20 kg
G. Metals			
104. Lead in solution		10 kg	2 kg
105. Nickel in solution		25 kg	5 kg
106. Zinc in solution		25 kg	5 kg
107. Copper (bluestone	solution	25 kg	5 kg
108. Arsenic	liquid/solid	10 kg	2 kg
109. Cadmium	solution/powder	10 kg	2 kg
110. Chromium	solution/powder	10 kg	2 kg
111. Selenium	solution/powder	10 kg	2 kg
112. Mercury	all forms	1 kg	100 g
113. Other metals	solution/powder	10 kg	2 kg
H. Radioactive Materials			
114. Diurante compounds	yellow cake	any amt.	any amt.
115. Radioactive isotopes		any amt.	any amt.
I. Waste Products			
116. Domestic liquid waste		n/a	300 L
117. Industrial liquid waste water		1000 L	100 L
118. Agriculture liquid waste (liquid manure		n/a	200 L

* Saskatchewan Petroleum Industry/Government Environmental Committee Guideline No. 3. January 1, 1999

Restoration of Spill Sites on Sask. Agriculture and Pasture Lands

** Spils equal or exceeding the above amounts must be immediately reported to the Spill Report Centre

APPENDIX VI: TOP 10 PRODUCT RANKING FOR EMERGING HERBS

Top 10 Product Ranking (Dollars) –Emerging Herbs by Product for June -August 1997

Rank No.	Product Name	Total Dollars	Dollar Growth	Dollar Share	Cumulative Share
	Total Emerging Herbs Segment	$61,914,104	132.7%	100.0%	
1	Gingko Biloba	20,798,464	117.2%	33.6	33.6
2	St. John's Wort	9,195,874	39,843.1%	14.9	48.5
3	Saw Palmetto	4,348,786	288.4%	7.0	55.5
4	Echinacea	2,990,652	149.1%	4.8	60.3
5	Echinacea & Goldenseal	2,165,978	83.4%	3.5	63.8
6	Evening Primrose	1,753,756	49.2%	2.8	66.6
7	Valerian	1,603,118	106.0%	2.6	69.2
8	Cranberry	1,447,416	57.0%	2.3	71.5
9	Pycnogenol	1,401,535	41.7%	2.3	73.8
10	Goldenseal	1,453,532	14.4%	2.3	76.1

Source: Information Resources Inc. Aug 24, 1997

APPENDIX VII: EXCERPTS FROM THE CANADIAN FOOD AND DRUG REGULATONS

Processed Products Regulations

PART I

3) A registered establishment shall

(a) in areas where raw materials, ingredients and food products are prepared, be constructed of material that is durable and free of any noxious constituent;

(b) be of sound construction and in good repair;

(c) be separate from and have no direct access to living quarters, livestock housing and areas in which operations are incompatible with the preparation of food products, including areas where animal food is prepared;

(d) be designed to prevent the entry of insects, birds, rodents and other vermin, and anything else that is likely to contaminate food products;

(e) not open onto premises used for the manufacture or storage of anything likely to emit fumes or odours that could adversely affect the edibility or palatability of food products;

(f) have, in any area where an exposed food product is prepared, floors, walls and ceilings that are impervious to moisture and constructed so that they can be easily cleaned and disinfected;

(g) have floors sloped for adequate drainage where drainage is required;

(h) have rooms and areas that have lighting, ventilation and plumbing that meet the requirements of the operations carried out in them, and are constructed so that they can be easily cleaned and disinfected;

in areas where food products, ingredients, food additives or packing materials are exposed, be equipped with light bulbs and fixtures that are of a type that will not cause food product contamination in the event of breakage;

(j) have lavatories, and if present, dressing rooms and lunch rooms, that

(i) are constructed so that they can be easily cleaned and disinfected,

(ii) are adequate in size and equipment for the number of people using them,

(iii) are well lighted and ventilated, and

(iv) in the case of lavatories, are separate from and do not lead directly into any room used for handling a food product;

(k) subject to subsection (4), be supplied with potable hot and cold water that is protected against contamination and is adequate in quantity and pressure to serve the potable water needs of the establishment;

(l) have adequate means for waste removal and disposal such that insects, birds, rodents or other vermin are not attracted to the establishment;

(m) have drainage and sewage systems that are

(i) in accordance with the plumbing code of the province in which the establishment is located,

(ii) adequate to handle all wastes,

(iii) equipped with traps and vents,

(iv) designed and constructed so that there is no cross-connection between the effluent of human or animal wastes and any other wastes in the establishment, and

(v) designed and constructed to prevent the contamination of food products in the establishment;

(n) have, for the preparation of a food product, equipment that is

(i) constructed of corrosion-resistant material, free of any noxious constituent and easy to clean,

(ii) accessible for cleaning, maintenance and inspection, or easily disassembled for those purposes,

and

(iii) effective for the purpose for which it is intended;

(o) have surfaces with which food products come into contact that are

(i) non-toxic,

(ii) smooth,

(iii) free of pitting, crevices and loose scale,

(iv) not adversely affected by food products,

(v) not adversely affected by repeated exposure to normal cleaning, and

(vi) non-absorbent;

(p) have facilities and means for the thorough washing, cleaning and sanitizing of equipment;

(q) be equipped with appropriate container cleaning equipment; and

(r) be equipped, if necessary, with means for establishing, maintaining and verifying the temperature and humidityof any room in which food products, raw materials, ingredients, containers or packaging materials are located.

(4) Water other than potable water may be used in a registered establishment if it is used solely for fire protection, heating systems or auxiliary services and there is no connection between the system for that water and the system for potable water.

5. (1) No food product shall be marketed as food unless the food product, including every component or ingredient,

(a) is edible; and

(b) was prepared in accordance with good manufacturing practice."

"edible" means a food product

(a) does not contain any filthy, putrid, disgusting, rotten or decomposed substance,

(b) is not adulterated or contaminated, and

(c) was prepared under sanitary conditions. (comestible)

PART III Registered Establishments

29. (1) The operator of a registered establishment shall operate and maintain the establishment as required by this section.

(2) The buildings, equipment, utensils and all other facilities of the establishment shall be maintained in a clean and sanitary condition.

(3) All refuse shall be removed at least once daily from within the establishment, unless the refuse is of a kind, or is stored in a place or in a manner, that odours will not adversely affect food products in the establishment and will not attract insects, birds, rodents and other vermin to the establishment.

(4) The land immediately surrounding the establishment shall be kept free of debris and refuse.

(5) The establishment shall be operated in accordance with the sanitation program described in the application for registration,or as approved by the Director.

(6) Operations in relation to the preparation of a food product in the establishment shall be carried out in accordance with good manufacturing practice.

(7) Notices shall be posted in prominent places in the establishment

(a) instructing employees engaged in the preparation of a food product to clean their hands immediately after using toilet facilities;

(b) prohibiting smoking; and

(c) prohibiting eating and drinking in food preparation areas.

(8) No material or coating shall be used to repair the floors, walls, ceilings, doors, windows and other parts of any room or area in which food products are prepared in the establishment unless

(a) the material or coating is listed in the Reference Listing of Accepted Construction Materials, Packaging Materials and Non-Food Chemical Products, published by the Department of Agriculture and Agri-Food on January 31, 1995, as amended from time to time; or

(b) the operator has received a letter of no objection from the Agency.

(9) The minimum illumination of working areas in the establishment, when measured at a distance of 75 cm from the floor, shall be

(a) in the case of processing and equipment cleaning areas, 330 lux; and

(b) in the case of product sorting and inspection areas, 550 lux.

(10) All lavatories, sinks and drains in the establishment shall be maintained in a manner that prevents any of their odours or fumes from pervading any room in which food products are prepared.

(11) An effective and safe pest control program shall be maintained in the establishment, and domestic animals shall be excluded from the establishment, subject to the Canadian Human Rights Act and the conditions set out in subsection (25).

(12) Any detergent, sanitiser or other chemical agent in a registered establishment shall

(a) not be used unless

(i) it is listed in the Reference Listing of Accepted Construction Materials, Packaging Materials

and Non-Food Chemical Products, published by the Department of Agriculture and Agri-Food on January 31, 1995, as amended from time to time, or

(ii) the operator has received a letter of no objection from the Agency;

(b) be properly labelled; and

(c) be stored and used in a manner that prevents the contamination of food products or a surface with which food products come into contact.

(13) Containers used in the establishment shall be maintained in a clean and sanitary condition and shall be free of any foreign material including any soluble contaminant.

(14) Equipment and utensils that come into contact with inedible or contaminated materials in the establishment shall be appropriately identified and not used to handle edible products unless such equipment or utensils are thoroughly cleaned and disinfected before being used.

(15) No food product or any substance used as a component or ingredient of a food product in the establishment shall be maintained in an environment that could cause that food product or substance, or the component or ingredient, to deteriorate or become inedible.

(16) Nothing that is likely to emit an odour shall be kept in any place in the establishment where it could adversely affect the palatability of a food product.

(17) No food product or anything used in its preparation shall be exposed to or come into contact with anything in the establishment that could adversely affect the quality, colour, appearance, flavour, wholesomeness or safety of the food product.

(18) If steam is used in direct contact with food to process a food product, or to clean containers and equipment in the establishment, the steam shall be generated from potable water.

(19) Raw materials intended for use in the processing of a food product in the establishment shall, in accordance with good manufacturing practice,

(a) be washed, as needed, to remove any soil, decomposed, filthy or foreign material, other contaminant or inedible substance; and

(b) be inspected, sorted and culled to remove any unfit material from the processing line.

(20) All persons engaged in the preparation of a food product in the establishment shall clean their hands thoroughly immediately after using toilet facilities and as frequently as is necessary to prevent the contamination of the food product.

(21) Every person engaged in the preparation of a food product in the establishment shall wear

(a) sanitary clothing and hair covering such that no hair may fall into the food product; and

(b) if gloves are used in direct contact with a food product, gloves that are made of an impermeable material and that are maintained in a sound, clean and sanitary condition.

(22) Subject to subsection (23), no tobacco, chewing gum or food, except water dispensed from a drinking fountain, shall be used in any part of the establishment where food products are prepared.

(23) If good manufacturing practice requires that equipment be attended at all times by a qualified person during its operation, that person may consume food and drink in the immediate area of the equipment when the equipment is in operation during periods scheduled for rest or meals, and there is no other qualified person available to attend the equipment during that time.

(24) No object or substance that could fall into or contaminate a food product shall be worn or used in the establishment by a person engaged in the preparation of a food product.

(25) A person who suffers from or is a known carrier of a communicable disease, or who has an infected lesion that is open or exposed, shall not work in any area of the establishment where there is a danger of contaminating with pathogenic micro-organisms a food product or a surface with which food products come into contact.

(26) For the purposes of subsection (25), "communicable disease" means a disease that is listed in World Health Organization (WHO) Technical Report Series 785 entitled "Health Surveillance and Management Procedures for Food-Handling Personnel", as amended from time to time.

APPENDIX VIII: BACKGROUND ON AQUATIC FISH PRODUCTION

Background on Canadian Aquaculture

Canadian aquaculture was thought to begin with the aboriginal peoples through the transfer of fish between the streams and rivers. However the first detailed records of Canadian aquaculture were not available until the mid 1800's. In the 1950's there was a network of federal and provincial hatcheries producing approximately 750,000 freshwater fish per annum for wild stock enhancement and non-commercial stock expansion.[18]

Commercial aquaculture is a relatively new industry beginning in the early 1970's and growing rapidly through the 1980's. There are aquaculture facilities operating throughout Canada although the majority of the industry is concentrated on either the east or west coasts. Salmon aquaculture in B.C. began in the late 1970's in the Sechelt Inlet and in the Albernie Inlet.

The Canadian aquaculture industry grew from $7 million in sales in 1984 to $256 million in 1991. Technological advancements, applied research and the aquaculture infrastructure also grew during this period. Low salmon values in the late 1980's resulted in bankruptcies and consolidation in the aquaculture industry. The restructuring in B.C. resulted in the number of aquaculture companies dropping down to 14 from 86 firms five years earlier. The number of sites also decreased down to 80-85 from 103.[19]

Production of finfish has increased dramatically in the past ten years. Across Canada the increase in finfish production has been over 500%. B.C. represents nearly 50% of the overall finfish production in Canada.

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[18] B.C. Environmental Assessment Office, Salmon Aquaculture Review, 1997

[19] B.C. Environmental Assessment Office, Salmon Aquaculture Review, 1997

Table 8: Canadian Aquaculture Production Statistics for Finfish 1998 vs.1988

Canadian Aquaculture Production Statistics for Finfish (tonnes)
1998 vs. 1988

	NFLD	NB	NS	PEI	QC	ONT	MAN	SASK	ALB	BC	TOTAL
1998											
Salmon	401	14232	1785	50	500					41923	58891
Trout	48	550		49		4500	14	875		383	6419
Steelhead	1316		1038		500						2854
Other											0
Total	1765	14782	2823	99	1000	4500	14	875	0	42306	68164
1988											
Salmon	9	3250	27		65					6368	9719
Trout	20	41	195	14	950	1830	23	50	23	113	3259
Steelhead										185	185
Cod	200										
Total	229	3291	222	14	1015	1830	23	50	23	6666	13163
%98/88	771%	449%	1272%	707%	99%	246%	61%	1750%	0%	635%	518%

*PEI and QC production numbers are estimates only
**Statistics from StatsCan

Although the increase in Canadian aquaculture production has been dramatic it has merely kept up with world production. B.C. produces approximately 4% of the world's farmed salmon. Farmed salmon now account for one-third of the world's annual salmon harvest. The UN Food and Agriculture Organization projects that by 2010, aquaculture will provide about 35 percent of the world fish supply for human consumption.

Table 9: World Salmon Production 1988 vs. 1995

World Salmon Production
(000 Tonnes)

	1988 Production		1995 Production	
	Tonnes	% Share	Tonnes	% Share
Norway	80.3	57.5	251	45.5
Chile	3.1	2.2	126.3	22.9
U.K.	17.6	12.6	65	11.8
B.C.	6.6	4.7	23.8	4.3
Ireland	4.2	3	16	2.9
E. Cda	3.3	2.4	14.7	2.7
U.S.	2	1.4	14.7	2.7
Japan	14.1	10.1	14.1	2.5
Faeroe Is.	3.4	2.4	12.4	2.2
Other	5.1	3.7	13.9	2.5
Total	**139.7**	**100**	**551.9**	**100**

*Sources: Price Waterhouse (1993), Kenney (1996)

Aquatic Production

The eggs which may be collected from the wild or from farm stock are incubated, hatched and reared in freshwater, usually in land based tanks but also in fresh water lakes. Eggs are hatched over a three to five month period, stored in trays with water running through them.

Once the eggs are hatched the fish are transferred to tanks or lake pens where they kept until they reach smolt stage. The smolts are then transferred to marine based cages for grow out.

A typical based salmon farm in B.C. is usually situated close to shore and occupies an area of two to three acres. The fish are kept in square steel cages which are normally 12 or 15 metres square. Farms have between 10-30 cages which are typically floating self contained facilities.

APPENDIX IX: DESCRIPTIONS OF NATURAL FERTILIZERS ON THE MARKET

Bat Guano
Not a common fertilizer for Canada. It is comprised of partially decomposed bat manure found in caves.

Bird guano
Once a common bulk fertilizer exported from South America throughout the world. Guano is the decomposed manure of sea birds of South America.

Blood meal
Produced from the collected blood of slaughtered animals which is then dried and ground. This product is often combined with manufactured chemicals such as urea formaldehyde to boost its nitrogen content.

Bone meal
Produced from the rendered bones supplied by the slaughter industry. Common fertilizer for the home garden market.

Canola meal
Canola meal is a byproduct of the canola crushing industry. It has the advantage of being lower in salts than other natural fertilizers. It is also commonly used as a filler in home market products.

Cattle manure
Commonly used as a bulk fertilizer on agricultural land close to where cattle are raised. It is relatively low in nutrients which can be compensated by applying large amounts. It is also useful for building up soil structure.

Chicken manure
Used extensively as a bulk natural fertilizer in the lower mainland due to its availability. It must be either processed or well rotted prior to use. The lower mainland faces some challenges with an overproduction of poultry manure versus available land for application. Groundwater contamination is also a concern.

Cottonseed meal
Cottonseed is not commonly used in Canada. It is also more for acidic soil plants.

Feather meal
Feather meal, while organically based, is often fortified with urea formaldehyde to add a greater nitrogen content.

Fish meal
Fish meal is derived from cooked ground waste material from fish processing plants. It is commonly used in potting soils and soil conditioners.

Horse manure
Horse manure is similar in nature and usage as cattle manure.

Liquid corn byproduct
This liquid is usually available in bulk near corn milling facilities and is spread on local fields. This product is not commonly used in Canada.

Oyster shell
Oyster shells are quite low in nutrients. Oyster shell is more commonly used for raising the pH of soil.

Peat
Peat is not normally considered a natural fertilizer but is a common product used as a soil conditioner or growing medium. Peat adds organic material to soil, prevents leaching of nutrients, and aerates soils.

Seaweed
Seaweed is generally used fresh as a green manure. It contains a significant amount of seaweed. It is not commonly used in western Canada.

Sewage sludge
In Canada, sewage is generally processed before using it as a natural fertilizer. There are several types of processed sewage sludge on the marketplace usually with added micro-organisms.

Sheep manure
Given the number of sheep grown in Canada, sheep manure is not a common natural fertilizer in Canada.

Steer manure
Dried, crumbled, screened and packaged steer manure is a common horticulture product. Generally composed manures have approximately 50% of the nitrogen of fresh manure but the product is more stable and easier to handle.

Tankage
Tankage refers to the dried and ground by-product of slaughterhouses. It is not commonly used as a natural fertilizer in Canada.

APPENDIX X: BACKGROUND ON RABBITS

Rabbit Utilization

Rabbits are an extremely versatile animal. Rabbits are utilized for several different purposes: as a food (protein) source, for its fur and wool, as pets, and for medical research. They are adaptable to many climates, and are easy to transport and market.

Rabbits for Food

Rabbits have been used as a source of protein since 1500 BC. In the centuries before refrigeration rabbits saved waste over the slaughter of larger animals as the entire rabbit would be eaten. Sailors used to distribute rabbits on islands in various sea lanes to be used as a source of food for passing vessels.

Rabbit meat is highly nutritious and compares favourably over other meats. Cholesterol level in rabbit meat is lower than chicken, turkey, beef and pork. Rabbit meat is lower in percentage of fat than chicken, turkey beef and pork. Rabbit has 795 calories per pound Chicken 810, Veal 840, Turkey 1190, Lamb 1420, Beef 1440, Pork 2050

Rabbits are highly productive with a short gestation and lactation period (40 offspring per year vs. 0.8 for cattle and 1.4 for sheep) FAO. Because of their ability to rapidly reproduce a 10 lb. doe rabbit can produce 320 pounds of meat in a year (more than a cow) (Arden). A rabbit also has an extremely high feed conversion ratio of 4:1 (4 lbs. of feed to product 1 lb. of meat).

Europe represents 75% percent of rabbit production. Global rabbit production in 1990 was estimated at 1.5 million tonnes with Italy being the top producer at 300,000 tonnes followed by France at 150,000. In North America, rabbit meat consumption, represents a very small percentage of the overall protein consumption due mainly to cultural taboos with eating animals more commonly associated with pets. It is estimated that 3500 – 5000 metric tonnes of rabbit meat are consumed in the U.S. annually.

Rabbits are outside traditional animal production in North America and commercial rabbit farms are relatively few in number. Statistics on rabbit production are rather difficult to obtain. The U.S.D.A. does not recognize the rabbit as an agricultural livestock animal. Animals officially recognized as livestock would not be allowed to be kept within city limits which would cause some problems with pet rabbit owners. An effort was made in the U.S. in 1972 to have the U.S.D.A. to have rabbits recognized as livestock failed due to a lack of support.

Rabbits for Fur

At one time in North America rabbit pelts were in great demand for the garment industry. Rabbit pelt farming had been a viable agriculture business and a profitable by-product from the slaughter industry but due to substitutes and cheaper imported pelts this market has all but disappeared.

Users of rabbit pelts require prime pelts from fully developed and mature adult rabbits. Unfortunately the demand for the meat carcasses from these large animals is very small. The meat demand is mainly for a "frier aged" rabbit which is only about five pounds and 12 weeks of age versus an adult rabbit which is over six months old and significantly larger. The frier pelt is not an economical size for the garment manufacturers and a mature rabbit suitable for pelts does not have a market for the carcass, consequently the production of rabbits for fur is very limited.

Rabbits for Wool

The Angora rabbit is the only practical breed suitable for wool production. Angora wool production involves shearing, clipping or plucking the wool from the living rabbit. These clippings are then spun into wool are sold usually to small manufacturers.

It is labour intensive and hence expensive to produce wool from Angora rabbits. The rabbits require special care such as specific diets, constant grooming and preventative maintenance to reduce the potential of wool block (similar to a hair ball). This precludes the possibility of large Angora rabbit herds and large scale availability of Angora wool. As a result there are no large commercial mills for Angora wool. Clothing manufacturers require large guaranteed supplies of Angora wool which is not possible under current technology.

Angora wool production and the products manufactured from Angora wool will continue to remain as a cottage industry for the foreseeable future.

Laboratory Rabbits

Rabbits are a valuable research tool and are used for medical research, product testing and educational programs in medical schools. In the U.S., approximately 600,000 rabbits are used annually for medical experiments and new product testing (agriculture alternatives). Increased consumer awareness, activities by Animal Rights Activists, and new testing alternatives (i.e. Draize Eye Test) has decreased the demand for laboratory rabbits over the past 20 years.

There are two fundamental problems with the production of laboratory rabbits. The first problem is that these rabbits must be raised under very strict growing conditions with specialized facilities and tightly controlled diets. Scientific specifications may include rabbits that are "specific pathogen free" requiring producers to maintain a sterile and closed rabbit facility. "Barrier Specific" rabbits are born by caesarian section and hand-raised to ensure no contamination. Such facilities must be licensed and are subject to unannounced inspections.

The second problem is unpredictable demand. Laboratories may suddenly request hundreds of a specific type of rabbit at a certain age for an immediate delivery. Being able to anticipate market demand and produce the appropriate rabbits is nearly impossible. Therefore growers who raise laboratory rabbits must also be able to merchandise rabbits into the meat industry.

Rabbits as Pets – Rabbit Breeders

The pet sector represents the largest segment of the rabbit industry. It is extremely difficult to determine the numbers of rabbits in this category due to the lack of statistics as well as the ability of the rabbit to reproduce.

There are approximately 45-50 different rabbit breeds. Throughout North America there are numerous clubs that focus on specific breeds. The American Rabbit Breeders Association based in Bloomington, IL, is the governing body of the various rabbit breeding groups.

North American Rabbit Industry

U.S. Rabbit Farming

The United States has an estimated 200,000 producers marketing 6-8 million rabbits annually. Annual consumption of rabbit meat is between 8-10 million pounds.[20]

Canadian Rabbit Production

The chart below represents StatsCan 1996 estimate of rabbit farms in Canada. This number does not represent the pet and hobby rabbit population in Canada.

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[20] Agriculture Alternatives, Rabbit Production, 1998

Table 10: Canadian Rabbit Production 1996

Canadian Rabbit Production StatsCan 1996		
	Nbr.Farms	Rabbits
Canada	**6394**	**285366**
NFLD	16	150
PEI	56	488
NS	136	1442
NB	102	1579
PQ	889	105649
ON	1952	120801
MB	432	8620
SK	652	7057
AB	1249	18982
BC	910	20598

The Rabbit Feed Industry

The rabbit feed industry is not considered to be a large business in either Canada or the U.S. Feed companies that manufacture rabbit feed generally manufacture either pet or livestock feeds as their primary business. Pet food companies typically produce their own formulas to be merchandised in pet stores and are packaged specifically for the rabbit owner. However it is believed that the rabbit feeds sold in pet stores are generally lower in nutritional value that those feeds produced by livestock feed companies.

The most common nutritional program for commercial or pet rabbits is through a prebalanced pellet ration. Rabbits require high levels of fibre, combined with protein and energy source as well as vitamins and minerals. This is commonly achieved through a ration of alfalfa hay and grain (oats, wheat, barley, soybean, etc.). Unfortunately the digestive system of rabbits are extremely sensitive so any health problems are generally blamed on commercially manufactured feed rather than management methods.

There are several management considerations involved in the feeding of rabbits. These include:

- -feed contaminated with pesticide residue can cause health problems
- -rodent or insect contamination
- -mold on pellets
- -consistency of feed
- -the requirement for "fresh feed" – the fresher the hay the greener the pellet
- -changing rations from one company to another
- -corn is potentially lethal when ingested by rabbits

Quality control is an important consideration for the production and manufacture of rabbit feed.

Rabbit Physiology

Commercial rabbit production involves the breeding and raising of rabbits for profit. The important physiological characteristics of rabbits are the ability to reproduce rapidly and have a high conversion of feed to weight gain. It is important to give a brief description of the rabbit digestion pattern before discussing feed types.

Rabbits are almost continual feeders, eating small meals at intervals of five to twenty minutes. The anatomy of the rabbit requires frequent feedings.

Unlike other mammals, the rabbit's stomach has a poor muscular structure and relies on pressure from successive meals to force partially digested meals from the stomach to the small intestine. Regular feedings allow for a steady progression through the digestive system.

Food from the stomach enters the small intestine where further digestion occurs. A valve at the end of this intestine at the junction of the caecum regulates the passage of food (digesta) allowing for a thorough digestion and prevents regurgitated food from re-entering the intestine.

The small intestine is then connected to the large intestine which is comprised of the caecum and the colon. The caecum has a spiral fold of the membrane and ends in a small pouch called the vermiform appendix. The colon extends from the small intestine and the caecum.

One important feature of rabbit digestion is its ability to separate large particles in the colon. The caecum, representing the larger part of the intestine is constantly in motion with a constant flux of mixed ingesta moving around the ceo-colon area. Peristaltic action moves the ingesta down the colon. Larger fibre particles are lower density and tend to stay in the centre of the tubal shaped colon. Smaller particles and liquid tend to accumulate around the circumference. Contractions of the colon wall move the material along the circumference in a retrograde manner to the caecum. Small particles and liquids tend to be retained in the caecum for a longer period of time whereas longer fibres are eliminated rapidly.

Rabbit fecal matter is composed of hard and soft pellets. Hard fecal pellets comprised of the longer fibrous material produced in the colon are expelled. Soft fecal pellets are passed through the colon from the caecum and consumed by the rabbit. This is known as coprophagy or cecotrophy.

Cecotrophy is an integral part of a rabbit's digestive process. Is necessary for maximum digestibility of high fibre (low energy) and low fibre (high energy) diets. It is particularly important for the digestion of protein. Research has demonstrated that through cecotrophy rabbits are more efficient in retaining protein when fed a low energy – high fibre diet. Low fibre diets reduce cecotrophy as movement through the large intestine is slowed and product is retained in the caecum for a longer period of time.

High fibre diets in addition to improving the feeding efficiency also aid in disease prevention. High fibre prevents the slowing down of the digestive process known as hypomotility. Hypomotility of the intestine is involved in diarrhea[21] (enteritis) and cecal impaction. Fibre helps prevent these disorders though the stimulation of motility either by a scabrous effect or/and through pressure.

Enteric diseases are a major cause of losses in commercial rabbit production. Loss from enteritis causes death in 10-20% of all animals born.

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[21] Diarrhea is rabbit refers to constipation or lack of gut mobility. In the case of rabbits, diarrhea and constipation are not mutually exclusive terms.

Nutrient Requirements of Rabbits

The following chart identifies the nutrient requirements of Rabbits. As reprinted from Rabbit Production.

Table 11: Nutrient Requirements of Rabbits

(Percentage or Amount per KG of Diet)

Nutrients	Growth	Maintenance	Gestation	Lactation
Energy & Protein				
Digestible energy (kcal)	2500	2100	2500	2500
TDN %	65	55	58	70
Crude fibre %	12	14	12	12
Fat %	2	2	2	2
Crude protein %	16	12	15	17
Inorganic nutrients				
Calcium %	0.40		0.45	0.75
Phosphorus %	0.22		0.37	0.50
Magnesium (mg)	300-400	300-400	300-400	300-400
Potassium %	0.60	0.60	0.60	0.60
Sodium %	0.20	0.20	0.20	0.20
Chlorine %	0.30	0.30	0.30	0.30
Copper (mg)	3.00	3.00	3.00	3.00
Iodine (mg)	0.20	0.20	0.20	0.20
Iron				
Manganese (mg)	8.50	2.50	2.50	2.50
Zinc				
Vitamins				
Vitamin A (IU)	580.00		>1160	
Vitamin A as carotene (mg)	0.83		0.83	
Vitamin D				
Vitamin E (mg)	40		40	40
Vitamin K (mg)			0.20	
Niacin (mg)	180			
Pyridoxine (mg)	39			
Choline (g)	1.2			
Amino acids (%)				
Methionine + cystine	0.65			
Arginine	0.6			
Histidine	0.6			
Leucine	0.3			
Isoleucine	1.1			
Phenylalanine + tyrosine	0.6			
Threonine	1.1			
Tryptophan	0.6			
Valine	0.2			
Glycine	0.7			

Rabbit Feed Composition

Alfalfa meal is recognized as a desirable feed for rabbits. In much of the U.S. and Canada alfalfa meal is the largest single component of commercial rabbit feeds.

The following section was taken from the book, "Rabbit Production" written by Dr. P. R. Cheeke et al.
The protein in alfalfa meal is well digested by rabbits, so a major part of the total protein requirement can be met with alfalfa. It is a good source of phosphorus and an excellent source of calcium and potassium. It provides indigestible fibre which helps prevent enteritis. It is the richest common plant source of vitamin A activity; dehydrated alfalfa meal may have over 60 times as much carotene as yellow corn, and over 4 times as much as carrots. Alfalfa is palatable to rabbits at moderate dietary levels. Thus it has many qualities that will ensure it continuing use as a rabbit feed. ...Recent studies at the OSU (Oregon State University) Rabbit Research Center have demonstrated good results with diets in which alfalfa replaced all of the grain.

Similar to other commercial animal feeds the formulation of an appropriate combination of ingredients is dependent upon diet requirements and value of available feedstuffs – also known as the least cost ration formula. Feed formulations are generally decided by animal nutritionists employed by feed companies.

Rabbit rations are generally processed into feed pellets. Rabbits have a preference for pelleted feed versus a mash form.[22] Pellets should be approximately ¼ inch in diameter, solid, firm and have a minimal amount of fines. The pellets should be well mixed and homogenous in nature as rabbits are unable to sort out individual feed ingredients. Also as discussed in the section of rabbit digestion, it is preferable that the feed pellets consist of coarsely ground material as finely ground material result in the digesta remaining too long in the caecum.

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[22] Cheeke, et al, Rabbit Production 1987

APPENDIX XI: BACKGROUND ON JAPAN AGRICULTURE MARKET

Reprinted from Agri-Food Trade Service, Agriculture and Agri-Food Canada.
Japan Agri-Food Export Market Assessment Report Feb. 1997

Characteristics of the Agriculture and Food Sector in Japan

Economic

Only 13% of Japanese land is suitable for agriculture. In, 1995 7.5% of the workforce in Japan was involved in the agricultural sector, 12% of the population lives on farms, but only 2% of GDP was generated by this sector. About 70% of all farms are less than one hectare, reflecting a labour intensive agriculture sector.

Japanese agricultural production is steadily contracting. Cereals, rice, dairy, beef, pork, and fruits and vegetables are all sharing in this decline. Labour shortages, land-use policies and price-support programs have driven up domestic production cost, making imports more competitive. This has led to a greater interest in establishing offshore production facilities. Japan also continues to invest in food processing ventures overseas, especially in Southeast Asia, Australia, and the United States.

Japanese agriculture is still a highly subsidized and protected sector. Crop yields are among the highest in the world, with its principal crops being rice, sugar beets, vegetables, and fruit. Animal products include pork, poultry, dairy, and eggs.

Japan has a large and powerful agricultural cooperative system consisting of many small farmers. This sector lobbies successfully for maintenance of small farms, high support prices, and tariffs on imports.

The Ministry of Agriculture, Forestry, and Fisheries (MAFF) is the official agricultural department which controls the amount of land in production, pricing, and distribution. Agencies of MAFF as well as the Ministry of International Trade and Industry (MITI) are involved in international trade through its import allocations.

Japanese agriculture is centered on rice, livestock products, fruits, and vegetables. In terms of production, consumption, and cultural significance, rice is Japan's most significant agricultural commodity. It accounts for one third of gross agriculture income and is cultivated on about 40% of the agricultural land. In the period 1983-1992, production averaged around 9.7 million tonnes annually on a milled basis. High support prices and lagging consumption created surpluses, forcing the government to begin reforms, including mandatory diversion of land to other crops and reductions in support prices. The 1993-94 crop suffered from poor weather, forcing Japan to import rice for the first time in thirty years. The 1994-1995 crop, however, resulted in a 53% increase in production over the preceding year, allowing Japan to replenish its stocks and delay importing its required GATT commitment quantity of rice for 1995 until late 1995/1996

Japan produces only nominal amounts of wheat, but as a major consumer it is among the top five wheat importing nations, with imports averaging about 6.2 million tonnes over the last five years . Consumption of wheat, for food use, has averaged just under 6.5 million tonnes. Japan is among the top five barley importing nations, with imports averaging 1.7 million tonnes in the previous five years. Japan also relies heavily on imports to meet consumer demand for beef, pork, and poultry.

Farm and Food Policy

In order to provide price and income support to its producers, Japan still maintains some protective measures on imported commodities. These measures include tariffs, quotas, and non-tariff barriers such as sanitary and phytosanitary requirements. Most domestically-produced commodities, including rice, beef, pork, and dairy products, are affected by one or more of these measures. Other major commodities receiving assistance through import quotas, support payments, or price guarantees are barley (for food), soybeans and rapeseed, livestock feeds, rye, and oats.

In June 1992, MAFF issued a report on the basic direction of new policies in the agricultural sector. This report outlined the areas of change needed and targets of future reform. The plan recognized that larger-scale farming needed to be encouraged in order to lower production costs, and to encourage younger farmers to stay in rural areas. Progress will depend upon the speed with which restrictions on the sale and leasing of farm land are being relaxed, and the government controls on rice are loosened.

In the summer of 1994, an advisory panel to the prime minister discussed policy measures regarding the basic future directions of Japanese agriculture, food and trade in the wake of the Uruguay Round Agreement. An interim report, released late summer 1994, outlines discussions held on the five main points: (1) basic concepts for food and agriculture policies, (2) policies concerning agriculture structure, (3) measures for agriculture in hilly and mountainous areas, (4) pricing policies for agricultural policies, and (5) rice control.

Market Access

General Information

In 1992, Japan introduced a five-year economic plan which called for the gradual introduction of deregulation and trade liberalization. Subsequently four deregulation packages have been introduced, reducing the scope and increasing the transparency of government regulations. This process will continue to improve market access in the agri-food sector.

In 1993, Japan introduced new import promotion policies. These were viewed as a mixed benefit as such measures are selective and discretionary. Japan has also increased the powers of its Office of Trade and Investment Ombudsman (OTO), which handles trade access complaints related to Japan's import regulations. The Food Sanitation Law and its administrative body, the Ministry of Health and Welfare, account for a major proportion of complaints registered with the OTO and its associated Advisory Council.

Japan does not belong to any preferential trading agreements, and has generally applied tariffs on a Most Favoured Nation (MFN) basis. However, its management of some major trade access issues has been largely based on bilateral negotiation. Japan's move to increased multilateralism, under such organizations as Asia Pacific Economic Cooperation (APEC) and the World Trade Organization (WTO), is a sign of improved dispute consultation and resolution.

Japan has only ever launched two anti-dumping actions and has never taken countervailing measures. However, in 1995 and again in 1996 Japan took safeguard measures on frozen beef and pork. This has had an significant market disrupting affect on pork trade in particular.

Historically, Japanese market access restrictions in the agri-food sector have taken the form of: tariff levels, quotas (now tariff rate quota's), a high degree of tariff escalation on processed products, non-tariff regulatory barriers, exclusionary business practices, and non-transparency of government import rules and regulations. In addition, Japanese governments have tended to demonstrate a relatively slow pace of adjustment to internationally accepted health, safety, and quality standards for feeds, foods, and genetic material.

Tariffs, Duties and Taxes

Under the Agreement on Agriculture of the Uruguay Round, Japan agreed to convert all import bans and quotas to tariffs (rice excepted,) and to bind and reduce all tariffs over the 1995-2000 period.

Most duties are by ad valorem rates, but exceptions include: pork and canola oil. In the case of pork, an ad valorem rate is in place for imports priced above the minimum gate price, while a specific differential rate is applied to imports below this price. The gate price for pork will be reduced by 30% by 2000. However, due to the increase in pork imports by Japan, the safeguard on pork has been in place for most of the fiscal year ending March 31 1997. The beef tariff will be reduced from 50% to 38.5% between 1995 and 2000. although beef also has a safeguard mechanism limit import surges. In the case of canola oil, Japan continues to apply high specific duties in comparison to duty free access for canola seed.

Japan agreed to "zero for zero" tariff reductions for beer (by 2002), whiskey, and brandy (2004). A WTO Dispute Settlement Body (DSB) panel ruled in late 1996 that Japan should harmonize its excise and related taxes on liquor products. Japan has proposed changes to its tax system, but a certain level of discrimination would continue between imported whiskeys and brandies on the one hand and domestic "shochu" on the other, after the implementation period.

The existing Japanese tariff structure does not differentiate between "food grade" peas for human consumption and "field peas" for use in livestock feeds. Peas are presently imported under a tariff rate quota of 10%. This tariff makes field peas non-competitive as a feed ingredient with other protein sources which enter duty-free (e.g., canola and soybean meals, dehydrated alfalfa).

Many tariffs on processed foods remain high. The average tariff on agricultural raw materials is 5% (peak of 74%), while for beverages it is 22.2% (peak of 85%), and for food products it is 16.3% (peak of 174%). The average tariff for agricultural raw materials will drop to about 3.7 percent under the Uruguay Round. In some cases, the bound level will remain above currently applied levels.

State Trading and Structural Barriers

Japan retains state trading arrangements for products including rice, wheat, barley, industrial alcohol, skim milk powder, and butter. The Japanese Food Agency is responsible for managing domestic supply and demand for rice, wheat, and barley; it is thus a major purchaser of Canadian wheat and barley. However, some companies in Canada recently achieved licensing rights to supply these grains to their own customers. In addition, in 1995, Japan agreed to measures which permitted Canadian participation in Japanese food-aid purchases.

With respect to domestic competition policy, the Japanese government has begun to reduce the massive network of horizontal and vertical business linkages. These networks, along with a heavy and confusing regulatory burden for imports, often limit access to Japan's market, particularly for high value added food products and beverages. The increased role of consumer cooperatives, deregulation in the retail sector, and growth in the restaurant trade appear to have contributed to the emergence of markets for highly processed imports.

APPENDIX XII: BACKGROUND INFORMATION ON SOUTH KOREA

Excerpts from the South Korea Action Plan Team
International Markets Bureau, Market and Industry Services Branch
Agriculture and Agri-Food Canada June 1997

Situation and characteristics of Korean agricultural sector

Until the 1960s, Korea was predominantly an agrarian economy. With a high population density and limited arable land, Korea specialized in intensive production of rice and other grain crops.

Seeking export-led industrial development and protection of domestic industries, Korea also pursued a policy of food self-sufficiency through highly-restrictive import policies. Agriculture's share of GNP and farm employment declined rapidly. In 1995, agriculture represented 7 percent of GNP, a decline from 28 percent in 1970 and farm employment accounted for 10 percent, a decline from 45 percent in 1970. A decline of the share of the agricultural sector to nearly 5 percent of GNP by the turn of the century is expected.

Korean agriculture is characterized by high cost and small owner-operated farms. Rice remains the dominant crop, accounting for about one-third of the total agricultural output value. Rice has a cultural significance beyond its economic status and is the centrepiece of Korea's agricultural policy. Korean farmers are highly dependent on farm activities for income. Off-farm income is evaluated at only 50 percent in comparison to 80 percent in Japan and 70 percent in Taiwan.

Soybean is Korea's predominant oilseed crop, accounting for about two-thirds of total oilseed production. Soybean use in Korea is mainly for human consumption. Meat production has risen annually with consumer demand. Of the total meat production, beef represented 14 percent, pork, 63 percent, and chicken, 23 percent. Fruit and vegetable production is the most dynamic sector of Korean agriculture. Fruit and vegetables account for 30 percent of agricultural production. Policy-induced changes from rice production to alternative crops thus increasing the importance of fruit and vegetable production in Korean agriculture in recent years. Annex A outlines South Korea's policy considerations for specific agri-food commodities.

The government of Korea has, in recent years, re-oriented its agricultural policy to improve Korean agricultural competitiveness and efficiency, and to assist farmers adjust to trade liberalization. Farm mechanization, promotion of high-value crops, exports of processed agri-foods, creation of industrial zones in rural areas, agricultural research, training and investments, are emphasized in the 1993 New Agriculture Plan and the 1994 Agriculture and Fisheries Development Plan.

OPPORTUNITIES AND CONSTRAINTS

General opportunities and constraints

WTO commitment: Korea is implementing its Uruguay Round commitments on a developing country basis, which means it will take 10 years rather than 6 to fully implement commitments for tariff reductions and quota liberalization. On July 1, 1997, imports of most meat products (pork, chicken and poultry) and seafood and fish products will be liberalized. By 2004 most products will be imported freely, although duties on many agricultural products will remain high.

Regulations and Procedures: Technical, sanitary and phytosanitary (SPS), and administrative regulations and procedures have also surfaced as access issues. A continuing issue, although Korea is in the process of implementing improvements, is lengthy import clearance times. Many shippers of perishable products avoid the Korean market for this reason. Other issues, such as changes in customs classification without warning, non-transparent specifications and standards, and inspection-quarantine procedures, also appear to be fairly common issues raised by traders. The perception is that the Koreans change market access rules in mid-stream and this makes companies wary of this particular market.

State trading: The use of state trading to import a wide range of products has been a challenge for Canadian exporters. This is largely because Korean organizations have sometimes been slow to recognize and implement tendering procedures attuned to the specific needs of particular users and sellers. In addition, certain import agencies are strongly linked to competing domestic interests.

Market focus: Koreans are travelling more and are exposed to new and different foods, although it may take some time for Koreans to incorporate North American food into their daily diet. We should pay some attention to the next generation of Koreans and their influence on consumption habits. For instance, a recent study in Korea indicated that children rated hamburger as their favourite item, and fathers came in second. There is a proliferation of fast food outlets in Korea and supplying this sector may offer some opportunities. Based on discussions with importers, Koreans like Canadian food products and can appreciate the quality but are not necessarily willing to pay for it. Cost appears to be one determining factor--if a lower priced product with a lower quality is available this will be the product of choice.

Food distribution system: The food distribution system in South Korea is quite fragmented and has not been rated as efficient. Very few food companies have a national distribution system or have a full range of products. As a result retailers as well as importers have to deal with a large number of wholesale distributors to buy or sell their goods. Furthermore, the transportation infrastructure is inadequate, thereby contributing to the inefficiencies in the whole system. This adds significantly to the cost of food, including imported foods. Working relationship with local Korean firms that have well developed distribution networks can be very successful. Imported frozen foods face some problems in Korea, and small and medium sized importers/distributors cannot afford to maintain a fleet of refrigerated trucks to distribute frozen food to retailers. Most retailers have very limited frozen storage or display cases and therefore cannot keep adequate stocks on hand and require frequent deliveries. It is reported that retailers sometimes return large portions of frozen food to producers for quality reasons even though the problem resulted from their mishandling of the product. Korea has also established shelf-life limits for frozen foods that are shorter than those in other countries.

Research activities: A good level of collaborative research involving South Korea has been developed in recent years. A leading trend in Asian biotechnology is its increasing application in agriculture, manufacturing and waste treatment. This represents a move from the potential of R&D to the realities of the work place. Though there is a growing awareness by Asians of biotech activities in neighbouring countries, active collaboration at either the R&D or commercial levels is still limited.

Packaging: New packaging and shelf life technologies could help Canadian exporters to gain a foothold in that market. Canada leads the way in preservative packaging technologies and have systems available to assure the export of high quality fresh Canadian pork and beef products to remote markets. Furthermore Canada benefits from superior and objective HACCP systems that can help gain the confidence of importers by guaranteeing safety. These technologies have been developed at the Lacombe Research Centre and remain a part of Canada's research focus.

Investment: Korean outward Foreign Direct Investment (FDI) in agriculture has been in the form of joint ventures, franchises or licensing agreements with host countries. Korean outward FDI has pointed to some ASEAN countries (Malaysia, Philippines and Thailand) and more recently China as major host countries. For instance, the Korean Starch Industry Co-operative entered a joint venture investment to build a starch factory in the Philippines to produce sweet potato starch. New Zealand invested in Korea, however, through a joint venture, Hansaeng, to develop and promote dairy products. Food service companies also are moving into Korea and to other international markets as they look to foreign countries for expansion. FDI will likely continue to grow, and companies will be more likely to expand their markets through foreign affiliates rather than through exports and imports of agri-foods.

Transportation in Canada: Transporting costs for moving products across Canada to export positions is a major competitive factor in the price-conscious South Korean market. As opportunities for value-added export sales are explored and pursued, the industry will be challenged to keep these costs to a minimum and to use systems that can accommodate a greater volumes of processed foods. Examples of issues on this front is the difference in highway quality from Alberta to BC, container facilities, intermodal shipment, and US port facilities. Alberta Transportation expressed concern about transportation infrastructure to ports across Canada. Alberta has maintained its highway system by attempting to maintain and expand the number of lanes (by twinning its highways) to its borders. This type of initiative may increase competitiveness in obtaining greater movement of processed food products across the country or to ports. Alberta expressed the view that this may be accomplished through a national infrastructure strategy.

Grains, oilseeds and their products

Wheat: Wheat, especially feed grade, has been the primary export commodity from Canada. Canadian exports of feed wheat to that market is dependent on availability. Annual exports of milling wheat are in the 75,000-100,000 tonnes range, representing about 5 percent of the imports of milling wheat.

Feed Barley: Korea's compound feed market is estimated 14 million tonnes, but its minimum access commitment for feed barley is extremely small in relation to import demand for feeds. Korea for 1996 opened a TRQ for feed barley of 50,000 tonnes which was filled with Canadian barley. Korea is expected to open a TRQ of 50,000 tonnes in early 1997; no such announcement was made as of mid-April 1997. Malt and Malting Barley: Malting barley sales have increased in recent years from 100 tonnes in 1993 to 40,000 tones in 1996 worth over $7 million. There is a potential for increased sales. Malt sales peaked at $24 million in 1995; the potential for more sales is good although a recent change to Korean import tariffs makes it more difficult for Canadian malt to compete with Korean malt produced from imported malting barley. The tariffs for malt and malting barley are 10% and 5%, respectively.

Special crops

Forages: South Korea is considered the third most important market for Canadian processed forage. Canada currently dominates the Korean alfalfa market, supplying high quality pellets and cubes, and baled hay. The forage industry is confident that demand will continue because Korea needs high quality forage and feed products to support development of its livestock sector, which is a high priority for them. Current applied tariff rate for alfalfa is 1% and Korean feed industry is actively pressing for tariff elimination. Prospects are good for the feed ingredients market over the next few years.

Dry Feed Peas: Significant growth potential exists in the South Korean feed market. Dry feed peas exporters and producers are in the process of creating a new entity (called Pulse Canada) to focus exclusively on market access and promotion of Canada's pulse crops. This industry has begun to draft a marketing strategy to present through the AIMS process. South Korea is very likely to become one of the priority markets for that product. Successful expansion into this market is contingent on two factors: starting education of potential buyers on the technical aspects and benefits of using peas as feed; and a lowering of the high tariff level currently in place on pea imports. In order to protect their market for food peas, Korea currently applies a tariff of 20% to **both food and feed peas.**

Dairy

Dairy Products: The South Korea market for dairy products has grown rapidly over the past ten years due to strong economic growth and diversifying consumers tastes. It is expected that 30-40% of domestic requirements will be imported by the year 2000. Largely because of the fast food market and trade liberalization, imports of cheese and mozzarella in particular, are growing. Also opportunities exist for the mild and soft cheeses, infant formula, lactose and whey products.

Dairy genetics: As part of its AIMS strategy, the industry is pursuing export sales of $1 million to this country by 2000 and $1.3 million in 2005. South Korea's dairy industry continues to grow and improve. This continues to provide opportunities for Canada to export higher quality cows and semen.

APPENDIX XIII: BACKGROUND ON TAIWAN AGRICULTURE MARKET

Reprinted from Agri-Food Trade Service, Agriculture and Agri-Food Canada.
Taiwan Agri-Food Export Market Assessment Report May. 1997

AGRICULTURAL PROFILE OF TAIWAN

Importance of Taiwan as an Agri-food Market

Taiwan's economy has changed dramatically over the last several decades. What used to be a largely agricultural economy accounting for 35% of GDP in 1952, has declined tenfold to 3.6% by 1995. Even more drastic is the drop in the proportional value of agricultural exports from around 95% to 4% in the same time period.

Agricultural activities are mostly located on the western plain, and northern and western coasts. About four million people, or one-fifth of the population, are still directly dependent on agriculture for their living and average farm size is about one hectare. Land use continues to shift away from agriculture mostly due to lack of profitability, labour shortages, and alternative land uses. This has forced many small farmers to look for alternative sources of income while part-time farming is becoming not only popular, but necessary. In general, agriculture in Taiwan is trending toward more specialized large scale farming operations, especially in hog, rice, and sugarcane production.

The government has plans to lower the number of workers from 1.1 million to 300,000 or 400,000 over ten years. Diversification of crops away from labour intense rice production figures prominently in the government's zero-growth target set for the agricultural sector.

Taiwan is currently our sixteenth largest market for agri-food, but it must be taken into account that their per capita income is growing steadily, that western foods are becoming more accepted, and the lowering of tariffs is evident with the joining of the WTO. Bovine hides are Canada's top export commodity, accounting for around half of agri-food exports since 1993. Exports in 1996 totalled $117 million, but growth in non-durum wheat, whiskies and waters, frozen beef, and others is evident.

Characteristics of the Agriculture and Agri-food Sector in Taiwan

Economic

The domestic agricultural sector in Taiwan hasn't grown in a long time. Reasons for this include: lack of labour, high land costs, health and safety questions, and liberalisation of markets under WTO ruling. Local production can not compete with imports. For many years the domestic market did not have to, thanks to high tariffs protecting them. It was fairly evident that a loss of domestic production such as peanuts, sugar and fruit would have to be endured to meet WTO requirements.

Rice is a major concern to the Taiwanese government as it is a staple in agricultural production, employing many and feeding all. To lose this market, they argue, would be devastating and it should be protected. Overall, agricultural import tariffs are scheduled to fall from their current 21.6% average to somewhere between 13% and 19%.

Agricultural imports are of great importance to Taiwan, and totalled US$ 8 billion in 1996. The US was the largest import market at US$ 2.5 billion and included goods such as fresh fruits and vegetables, fruit juice, beef, wheat, corn and soya beans. There exists a large and rapidly growing market for consumer ready, prepared foodstuffs.

The quantity of imports for Taiwan is unquestionably growing. All of the factors that affect the need for imports are working simultaneously such as the zero-growth plan, the changing tastes, and the WTO bid. The market is ripe and it is imperative that potential products are introduced immediately.

APPENDIX XIV: BACKGROUND ON MEXICO AGRICULTURE MARKET

Reprinted from Agri-Food Trade Service, Agriculture and Agri-Food Canada.
Mexico Agri-Food Export Market Assessment Report July 1998

Importance of Mexico as an Agri-Food Market
Agriculture including forestry and fishing, was the most dynamic sector of Mexico for many years. However, the contribution to GDP fell from around 16% in 1960 to 7.7% in 1990 and 6.8% in 1992. Mexico is the third largest producer of coarse grains in the OECD, behind the US and the EU, and has the fourth largest beef herd. Even so, the output of these products is insufficient to meet the country's growing consumption, so it is becoming an increasingly large net importer of these and many other agri-food products.The share of Mexican export earnings of food and live animals fell from 31% of total exports in 1970 to 9.2% in 1980 and 8% in 1996. The most important products are beans, wheat, sorghum, sugar, corn, fruits and vegetables, eggs, cotton, and coffee. The leading agricultural export products are coffee, cotton, sugar, fresh vegetables and fruit.

Total 1996 import of agri-food products (including corn, sorghum, beans, oilseeds, wheat, barley, fresh and dried fruits) was over US$2.3 billion (4.6% from Canada). Agricultural exports had a total value of about US$ 5.6 billion.

The principal agricultural area is the Central Plateau, primarily producing corn and dry beans on small production units; and the Northwest region producing vegetables, wheat and soybeans on large privately-owned farms; North Central and Gulf area produce beef and dairy, sorghum and beans. Recurring droughts have led to a significant increase in imports of basic agri-food commodities to almost 30% of total imports.

The OECD forecasts that total meat consumption (which was estimated to have dropped in 1995 because of the liquidity crisis), will exceed 1990-94 averages by the year 2000, but largely because of the increase in poultry consumption. Beef and veal, and pork consumption, will be below 1990-94 averages.

In 1997, Mexico was Canada's seventh largest agri-food market, importing agri-food valued at $450 million, up 5% from 1996. Total Canadian imports from Mexico reached $351 million. Since 1988, Canada/Mexico agri-food trade has been relatively erratic, shifting from surplus to deficit and back again, as shown in Graph 2.1. For the last seven years, the balance has favoured Canada, with the greatest increase in the surplus in the first year of NAFTA. Main agricultural imports from Mexico are horticultural products (both fresh and processed), coffee and spirits.

The increase in Canadian agri-food exports to Mexico is due mainly to strong growth in wheat and canola shipments which made up 85% of our total agri-food exports to Mexico in 1997. Exports of canola seed, which were almost eliminated from the Mexican market in 1989/90, reached over $208 million in 1997.

NAFTA provides good export opportunities for wheat, barley, canola, beef, dairy, and swine genetics, processed foods and beverages.

Characteristics of the Agriculture and Agri-Food Sector in Mexico

Economic

Mexico's agri-food sector cannot produce enough food to feed its current population of 97 million. Agricultural production makes up only 5.4% of GDP and is declining as the economy develops and diversifies. This has historically made Mexico a net agricultural importer. Only in 1995 did the agricultural trade deficit temporarily correct itself when Mexico recorded US$3.9 billion of exports and US$2.6 billion of imports. The US holds approximately 70% of the market followed by Canada's 7%.

Mexico's food producing shortage is attributed to outdated technology, insufficient infrastructure, and a lack of access to financing. Over 70% of Mexican farms are subsistence or community farms and lack the necessary economies of scale to be productive. Mexico has 27 million productive hectares but the average farm size is 5 hectares. Less than 7 million hectares have access to irrigation. Rough terrain and traditional adherence to labour intensive cultivation impede mechanisation and improved technologies.

Mexico's agriculture can be classified into two sectors: an import-substituting sector, producing basic grains and oilseeds; and an export-oriented sector producing products such as fruits, vegetables, sugar and coffee. In 1996, about 27% of total agricultural output was accounted for by corn and other basic grains. The production of corn accounts for the major share of employment in rural areas.

Close to 80% of Mexico's arable land produces bulk commodities but contributes to less than 50% of the crop value. As the NAFTA increasingly makes exports of high value horticultural crops more attractive, it is expected that less land will be used to produce bulk commodities. As a result, Mexico will become increasingly reliant upon imported bulk commodities. Mexico already offers excellent opportunities for grains and oilseeds and further opportunity exists for pulses, beef, pork, temperate climate fruits, fish, dairy products and seed potatoes.

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